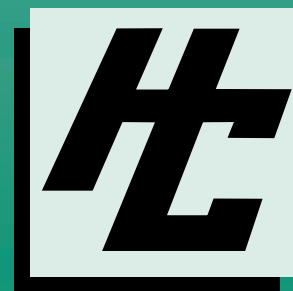


 Lawrence Livermore National Laboratory

# Hazards Control Department

1995

Annual Report



#### DISCLAIMER

This document was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor the University of California nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or the University of California, and shall not be used for advertising or product endorsement purposes.

This report has been reproduced  
directly from the best available copy.

Available to DOE and DOE contractors from the  
Office of Scientific and Technical Information  
P.O. Box 62, Oak Ridge, TN 37831  
Prices available from (615) 576-8401, FTS 626-8401

Available to the public from the  
National Technical Information Service  
U.S. Department of Commerce  
5285 Port Royal Rd.,  
Springfield, VA 22161

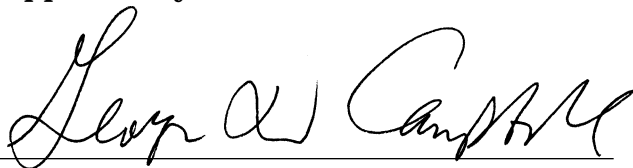
# **Hazards Control Department**

# **1995**

# **Annual Report**

**August 1996**

**Approved by:**

A handwritten signature in black ink, appearing to read "George W. Campbell", written over a horizontal line.

**George W. Campbell, Department Head  
Hazards Control Department**

**8/19/96**

---

**Date**



# Contents

<b>Acronyms.....</b>	<b>vi</b>
<b>Preface.....</b>	<b>viii</b>
<b>I. Overview.....</b>	<b>1</b>
<b>II. Organization.....</b>	<b>3</b>
Administrative Services Division .....	3
Environment, Safety, and Health Teams.....	3
Technical Support and Policy Development Division .....	4
Safety Laboratories Division .....	4
Emergency Management Division .....	4
Special Projects Division .....	5
Education, Training, and Safety Analysis Group.....	5
<b>III. Department Accomplishments—1995 .....</b>	<b>6</b>
Audits, Oversight, and Monitoring of Corrective Actions .....	6
ICF Decommissioning Project.....	6
Review of DTED Programs .....	6
Certification Panel for BEEF at NTS.....	6
Root-Cause Identification, Risk Assessment, and Control .....	6
Review of SAR and FSP for the Plutonium Facility.....	6
Reconfiguration of the Tritium Facility.....	6
Upgrade to the Criticality Alarm System in B332 .....	6
Review of Main Charge Explosive Component Manufacturing Proposal .....	6
Preliminary SAR for NIF .....	7
Fire Protection System at Device Assembly Facility .....	7
W-55 Dismantlement Activities .....	7
Industrial Hygiene Support .....	7
Radionuclide Sampling System Upgrade .....	7
W-79 High Explosives Dissolution Workstation.....	7
Full-Scale Fire Testing of Flammable Waste Drum Storage Areas .....	7
Stockpile Dismantlement Database .....	8
Safety Analysis Activities .....	8
Management Commitment and Involvement .....	8
Support for Off-Shift H&S Technician Program .....	8
Human Resources.....	8
Wellness.....	8
Facilities Activities .....	8
HCD Institutional Activities .....	9
HCD External Activities .....	9
Solutions Through Innovation and Creativity .....	10
Categorization of Chemicals for Impoundment.....	10
Reuse of Enclosed Hazardous Materials for DUS .....	10
Waste HEPA Filter Sampling Project .....	10
W-79 Dissolution Workstation .....	10
Student and New Hire Safety Orientation .....	10
Budget and Financial Information Enhancements .....	11
Assurance Activities .....	11
Fire Protection Support.....	11
New Analytical Method.....	11

SLD Activities .....	11
Belarus Mobile Laboratory .....	11
Health and Safety Training Activities.....	12
Simplification of ES&H Elements.....	13
<i>Health &amp; Safety Manual</i> .....	13
Fire Protection Support.....	13
Radiation Protection Support .....	13
Training Development .....	14
Development of NFPA Standard 115 .....	14
Necessary and Sufficient Task Force Activities.....	14
ES&H Guide for the Safeguards and Security Department.....	14
OSPs for Long- and Short-Term Facility Shutdowns.....	14
Electric and Magnetic Fields Program for the California PUC .....	14
Emphasis on Real ES&H Issues .....	14
Support for USAF Peacekeeper Flight Tests.....	14
Support for W-79 Dismantlement at Pantex.....	14
Decontamination of Former Test Program Laboratories in B151.....	15
Fire Protection Support.....	15
Radiation Protection Support .....	15
Support for Programmatic Activities.....	15
Laser Guide Star Installation at Lick Observatory .....	15
LLNL Policy for Refrigerants.....	15
Two-Way Communication, Trust, and Perserverance .....	16
Record Keeping .....	16
Quality Assurance .....	16
Radiation Protection.....	16
Recognition of Quality Work and ES&H Excellence .....	16
National ACGIH Award .....	16
Edgar Monsanto/Queeny "Safety Professional of the Year" Award from ASSE.....	16
1993 Weapons Recognition of Excellence Awards.....	16
Radiation Safety Training .....	17
Radiation Instruments and Calibration.....	17
Personnel Dosimetry Projects .....	17
Analytical Laboratory Metals Certification .....	17
Fire Prevention Education.....	18
P-32 Intakes Project.....	18
Internal Dosimetry Assistance Team .....	18
Beryllium Air Monitor .....	18
Occupational Safety and Health Support .....	18
NEST Support .....	18
Measurement and Feedback to LLNL .....	19
Industrial and Explosive Safety Support .....	19
Injury, Illness, and Fire Loss Statistics .....	19
Ionizing Radiation Trends .....	21
<b>IV. Customer Services .....</b>	<b>22</b>
ES&H Team Services.....	22
Safety Laboratories Division Activities.....	22
Emergency Management Division Activities .....	23
Permits Issued by EMD .....	24
Fire Prevention Inspections.....	24

EMD Dispatch Center (Bldg. 313) Activities .....	24
Cost of Fire Protection.....	24
Self-Contained Breathing Apparatus (SCBA) Serviced .....	25
Classes Given by Hazards Control.....	25
PHAs and SARs Performed During 1995.....	25
<b>V. Support to Significant LLNL Incidents.....</b>	<b>26</b>
Centrifuge Failure .....	26
Employee Fall .....	26
Power Outage .....	26
Finger-Ring Dosimeter Contamination .....	26
Beamlet Spatial Filter Implosion.....	26
<b>VI. Professional Publications and Presentations .....</b>	<b>28</b>
<b>VII. Areas of Concern.....</b>	<b>29</b>
Off-Shift H&S Technician Program .....	29
DOE Order Reduction Effort.....	29
Safety Analysis Support .....	29
Hazards Control Design Review .....	30
Inspection and Recertification of Pressure Vessels and Systems.....	30
Available Resources vs. Legacy Facility Issues .....	30
Attrition in Key Personnel.....	30
Injury and Illness Statistics .....	30
Criticality Safety .....	31
<b>VIII. Plans for 1996.....</b>	<b>32</b>
ES&H Team Plans .....	32
NIF Design.....	32
Radioactivity Allowance Tracking System .....	32
Partnership Program Pilot.....	32
Construction Subcontractor Safety Plan .....	32
Donation, Utilization, and Sales.....	32
Accident Prevention Program and Strategic Plan .....	32
Administrative Services Division.....	33
Technical Support and Policy Development Division.....	33
Direct Access to Material Safety Data Sheets .....	33
Electrical Safety Advisory Board.....	33
Education, Training, and Safety Analysis Group.....	33
More CBT and WBT H&S Training.....	33
Multimedia Hardware Evaluation.....	33
<b>IX. References.....</b>	<b>34</b>

## Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists
AD	Associate Director
AIHA	American Industrial Hygiene Association
ANSI	American National Standards Institute
APP	Accident Prevention Program
ARG	DOE Accident Response Group
ASD	Administrative Services Division
ASSE	American Society of Safety Engineers
BEEF	Big Explosives Experimental Facility
BLS	Bureau of Labor Statistics
C&MS	Chemistry and Materials Science
CBT	Computer-based training
CFIRS	California Fire Incident Reporting System
CSL	Calibrations and Standards Laboratory
DMSO	Dimethyl sulfoxide
DNFSB	Defense Nuclear Facility Safety Board
DoD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
DOELAP	DOE Laboratory Accreditation Program
DTED	Defense Technologies Engineering Division
DUS	Donation, Utilization, and Sales
EM	Environmental Management (DOE)
EMD	Emergency Management Division
EPA	Environmental Protection Agency
EPD	Environmental Protection Department
ES&H	Environment, Safety, and Health
ET&SAG	Education, Training, and Safety Analysis Group
FSP	Facility Safety Procedure
FTE	Full-time equivalent [employee]
GPP	General Plant Project
H&S	Health and Safety
HA&SA	Hazards Analysis and Safety Assessment
HCD	Hazards Control Department
HEPA	High-efficiency particulate air (filter)
HPS	Health Physics Society
HWM	Hazardous Waste Management



LANL	Los Alamos National Laboratory
LBNL	Lawrence Berkeley National Laboratory
LEDO	Laboratory Emergency Duty Officer
LLNL	Lawrence Livermore National Laboratory
MIST	Management Information System Team
MIT	Massachusetts Institute of Technology
MSDS	Material safety data sheets
NAI	Non-Proliferation/Arms Control and International Security Directorate
NESHAP	National Emission Standards for Hazardous Air Pollutants
NEST	Nuclear Emergency Search Team
NFPA	National Fire Protection Association
NIF	National Ignition Facility
NIH	National Institutes of Health
NTS	Nevada Test Site
OSHA	Occupational Health and Safety Administration
OSP	Operational Safety Procedure
PE	Plant Engineering
PHA	Preliminary Hazard Assessment
PUC	Public Utilities Commission
R&D	Research and Development
RCM	Radiation Control Manual
RCRA	Resource Conservation and Recovery Act
RCT	Radiation Control Technician
RPP	Radiation Protection Plan
S&SD	Safeguards and Security Department
SNL-CA	Sandia National Laboratories/California
SNL-NM	Sandia National Laboratories/New Mexico
SAR	Safety Analysis Report
SCBA	Self-Contained Breathing Apparatus
SDDB	Stockpile Dismantlement Database
SLD	Safety Laboratories Division
SPD	Special Projects Division
TRADE	Training Resource and Data Exchange
TSPD	Technical Support and Policy Development Division
TSR	Technical Safety Requirement
UC	University of California
WBE	Work Budget Element
WBT	[World Wide] Web-based training

## Preface

This annual report of the Hazards Control Department activities in 1995 is part of the department's efforts to foster a working environment at LLNL where every person has the means, ability, and desire to work safely. The significant accomplishments and activities, the various services provided, and research into ES&H issues by HCD would not have been possible without the many and ongoing contributions by its employees and support personnel. The HCD Leadership Team would like to thank each and every one in the department for their efforts and work in 1995 and for their personal commitment to keeping one of the premier research institutions in the world today a safe and healthy place.

If readers have any questions concerning the information in this report, feel free to contact the appropriate member of the HCD Leadership Team:

Department Head—George Campbell  
Deputy Department Head—Jim Jackson  
ES&H Team 1 Division Leader—Yee Ping Chong  
ES&H Team 2 Division Leader—Mike Trent  
ES&H Team 3 Division Leader—Al Celoni  
ES&H Team 4 Division Leader—Steve Carr  
Assistant Department Head/Administrative Services Division Leader—Joel Wong  
Technical Support and Policy Development Division Leader—Dave Myers  
Safety Laboratories Division Leader—Becky Failor  
Emergency Management Division Leader—John Sharry  
Special Projects Division Leader—Chuck Prevo  
Education, Training, and Safety Analysis Group Leader—Scott Hildum

Additional Contributors:

Linda Achziger, Corky Burgin, Ralph Burklin, Thad Kedzierski, Sue Koopman, Nancy Kuret, Pete LaCurtis, Sharon Miraglia, Melody Pelzl, Evie Prevo, Dave Prokosch, and Sharon Schumacher

General Editor:

John Richards

# Hazards Control Department Annual Report

## I. Overview

Since its founding in 1952, Lawrence Livermore National Laboratory (LLNL) has evolved into a world renowned, multidisciplinary scientific and engineering research facility operated by the University of California (UC). Lawrence Livermore has also become a leader in the area of health and safety. The Hazards Control Department (HCD) at LLNL is a primary contributor to Lawrence Livermore's success in protecting the health and safety of its workforce and that of the broader community, including the Department of Energy (DOE) Complex and the general public.

The department employs approximately 300 professional specialists and technical personnel who have expertise in industrial safety, industrial hygiene, explosive safety, criticality safety, fire fighting, fire protection, health physics, safety analysis, safety and health education, training, and research. HCD is one of three Environment, Safety, and Health (ES&H) departments that report to the Associate Director (AD) of Plant Operations at LLNL. In collaboration with the other two departments, Health Services and Environmental Protection, HCD leads in integrating risk minimization and control of workplace hazards into the thoughts, plans, and actions of Lawrence Livermore management and staff.

The primary purpose of HCD is to foster a working environment where staff, subcontractors, and visiting researchers at LLNL have the means, ability, and the desire to work safely. This is by no means a simple task, given the diverse nature of the work of LLNL's 8,000 scientists, engineers, and support staff and 1,500 on-site contractors. Their efforts include research into issues associated with national security, energy, the environment, and biomedicine; economic competitiveness; and science and mathematics education while continuing to carry out the Laboratory's historical role in nuclear weapons, stockpile management, and international treaty verification.

The Hazards Control Department vision is:

*"The individuals in Hazards Control will enhance the mission of LLNL and its programs by being an integral part of each program and by participating in the planning and execution of existing and new experiments and the design, construction, and maintenance of equipment and facilities. The professional expertise of our department and*

*the personal integrity of its individual members will be held in the highest esteem by our Laboratory colleagues, the University of California, agencies of government, and the general public. We will be a center of excellence and advancement in the field of occupational health and safety."*

In support of this vision, HCD programs and staff have become nationally recognized for participation and involvement in setting both national and international health and safety standards and policies. HCD staff members actively participate in various ES&H programs for the DOE, and also work with other regulatory agencies and related advisory committees to help draft new and revised health and safety standards. In many cases, the research programs of HCD's Special Projects Division (SPD) provide the scientific and technical basis for the development of new health and safety standards that are used throughout the nation and, in some cases, the world.

In 1993, the department was reorganized in an effort to better meet the needs of its LLNL customers and their changing missions. Removal of a complete layer of management gave more authority and responsibility to the ES&H Teams that provide direct support to the various Laboratory programs. At that time, the Department Head committed HCD to a concept that came to be known internally as the Accident Prevention Program (APP). The philosophy of the program is simple and straightforward. It provides a continuously improving atmosphere in which

- Accidents are neither expected nor condoned by the Laboratory
- The safety of people and the environment are held in the highest regard
- Property is protected
- Potential causes of accidents are controlled
- Both the Laboratory and the individual are held accountable for unsafe behavior.

HCD employees identified the essential elements of the APP as

- Management leadership
- Establishment of ES&H controls
- ES&H education through training

- Efficient and effective use of resources
- Employee commitment
- Integration of ES&H principles into research and development (R&D) and operations at Lawrence Livermore
- Clear assignment and acceptance of responsibility and accountability
- Use of a behavior-based approach to ES&H management.

In addition, the department and its staff had to make a commitment to these elements by supporting efforts at

- Audits, oversight, and monitoring of corrective actions
- Root-cause identification, risk assessment, and control
- Management commitment and involvement
- Solutions through innovation and creativity
- Simplification of ES&H elements
- Emphasis on real ES&H issues rather than compliance

- Two-way communication, trust, and perseverance within HCD and with clients, customers, and other contacts
- Record keeping
- Recognition of quality work by employees and excellence in ES&H
- Measurement and feedback to LLNL on its efforts to
  - Reduce accidents
  - Reduce environmental incidents
  - Reduce occurrence reports
  - Reduce worker compensation cases and cost.

This report summarizes the state of the department and HCD's efforts on the APP for the Laboratory as a whole in calendar year 1995. It describes the organization, accomplishments, customer services provided, significant incidents during the year, and HCD incident response. It also includes results of health and safety (H&S) performance measures, lists publications and presentations, discusses performance areas of concern, and describes the department plans for 1996.

## II. Organization

The Hazards Control Department is composed of ten divisions: Administrative Services; the four Environment, Safety, and Health Teams; Technical Support and Policy Development; Safety Laboratories; Emergency Management; Special Projects; and Education, Training, and Safety Analysis. The organization chart is shown in Fig. 1. A description of each division is given below.

### Administrative Services Division

The Administrative Services Division (ASD) has 11 employees. It is tasked with providing support to the Hazards Control Department in the following areas: (1) human resources coordination; (2) budget management; (3) vehicle and facility management, including office and laboratory space; and (4) quality assurance oversight.

### Environment, Safety, and Health Teams

The four ES&H Teams, which are separate divisions of HCD, have about 25 employees each. They provide environment, safety, and health support to the various research and support organizations at Lawrence Livermore. Each team supports specific

program areas; members include both technicians and professionals from different fields of safety and health. In addition, specialists from the Environmental Protection Department (EPD) and Health Services are assigned to these teams (Fig. 2).

The mission of the teams is to provide both high-quality and timely environmental, safety, and health support to Laboratory programs and organizations in alignment with not only the customer organization's mission, vision, and purpose, but also with the mission, vision, purpose, and core values and beliefs of the Hazards Control Department.

The ES&H Teams achieve their respective missions by working closely with LLNL programs to foster an atmosphere of cooperation in accident prevention and problem solving. As part of their daily activities, team members advise, monitor, and evaluate programmatic activities; provide emergency response services; and assist in training program personnel. The teams also perform audits and inspections, conduct incident analyses and accident investigations, restrict operations that are imminent hazards, and inform top program management of ES&H issues when appropriate.

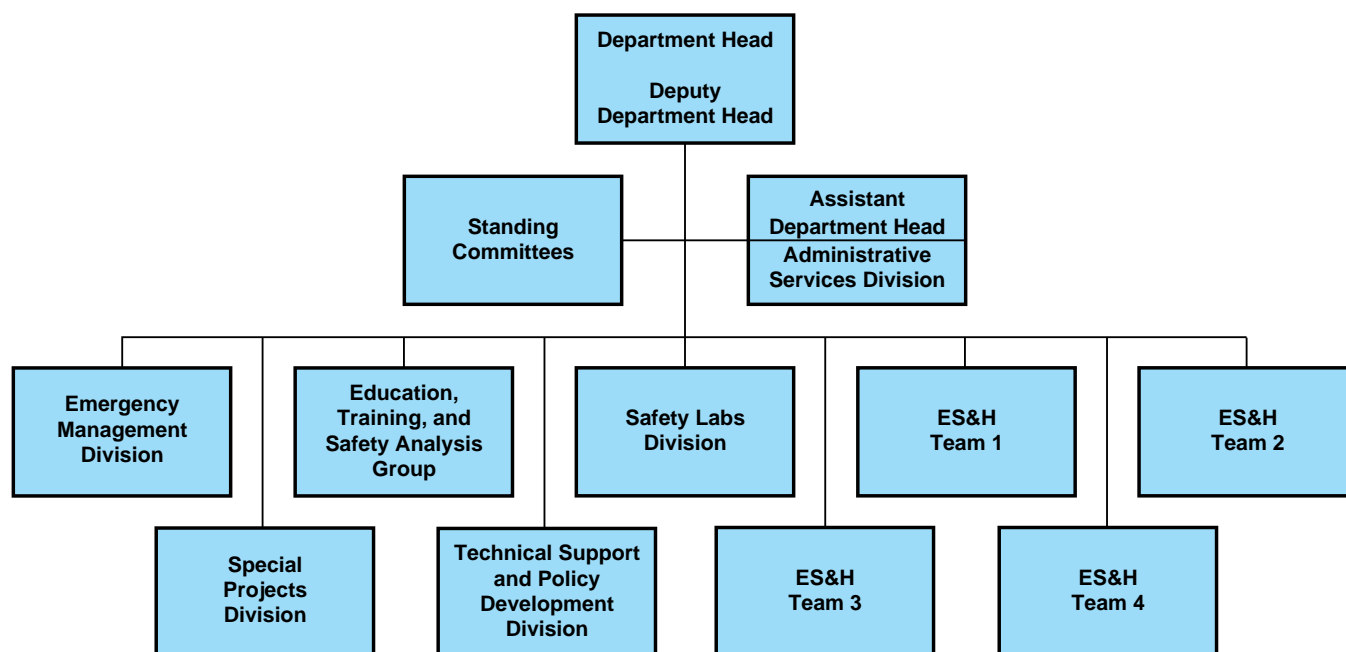


Figure 1. Organization chart for the Hazards Control Department at LLNL.

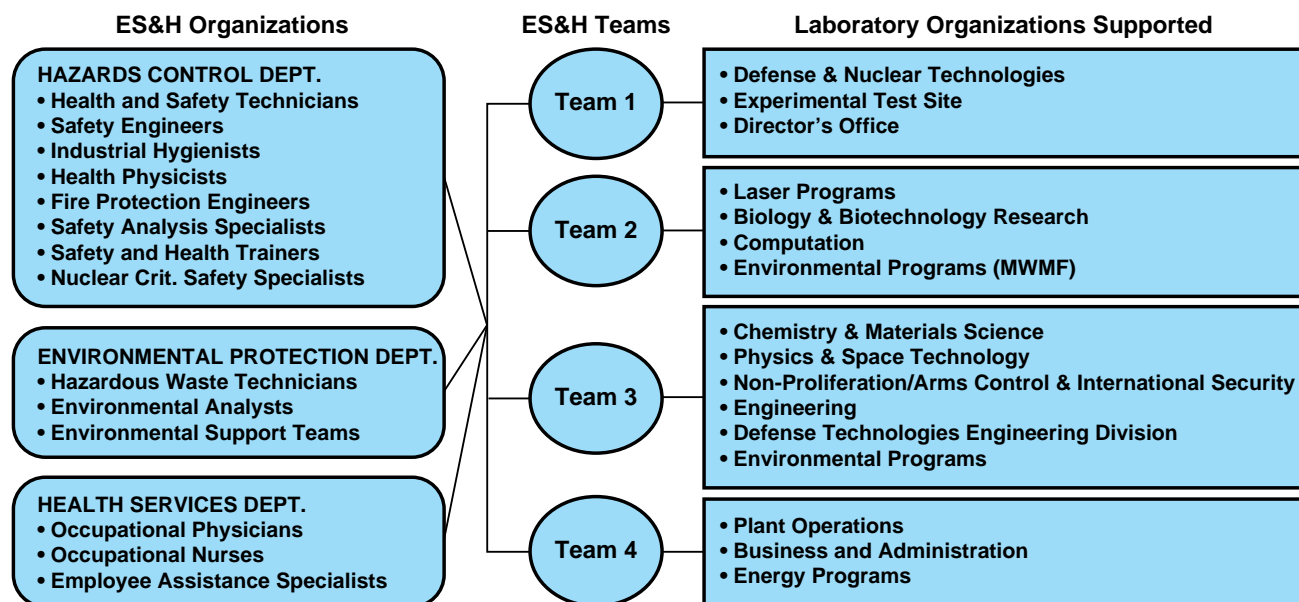


Figure 2. Teams of specialists and technicians provide services to the LLNL programs and overhead organizations.

## Technical Support and Policy Development Division

The Technical Support and Policy Development Division (TSPD) has 23 employees. TSPD is responsible for providing technical leadership and support to the safety and health discipline members and technicians in HCD. This division is also responsible for coordinating the development and publication of the *LLNL Health & Safety Manual*<sup>1</sup> and maintaining an electronic version of the manual.

TSPD designates technical leaders for fire safety, criticality safety, industrial safety, industrial hygiene, and the health physics disciplines, and also designates a lead person to represent the technicians. These technical leaders are responsible for working with the respective ES&H team members to develop and disseminate safety and health guidance and policies that are technically sound, compatible with regulations, and consistently applied across the Laboratory.

## Safety Laboratories Division

The Safety Laboratories Division (SLD) has 42 employees. SLD provides analytical equipment and laboratory services to Lawrence Livermore programs and organizations.

This division is tasked with providing quality analytical equipment and laboratory services in support of the Industrial Hygiene and Health Physics

programs. SLD division facilities and services include the Analytical Laboratory, Radiation Measurements Laboratory, Industrial Hygiene Instruments and Measurements Laboratory, Calibration and Standards Laboratory, Personnel Dosimetry Laboratory, Respirator Services, Bioassay Laboratory, and Whole Body Counter Laboratory.

## Emergency Management Division

The Emergency Management Division (EMD) has 51 employees. The EMD, which is more commonly known as the LLNL Fire Department, responds 24 hours a day to emergency incidents on the Lawrence Livermore site, at the Sandia National Laboratories/California (SNL-CA) properties, and in the surrounding community.

This division's charter is to respond to emergency incidents to limit injuries, loss of life, and property losses at the Laboratory and in the surrounding community. In support of its charter, EMD performs the following functions: nonsecurity emergency dispatch and response, fire prevention, liaison and coordination with emergency agencies of the communities surrounding LLNL, and emergency planning.

The division's modern emergency dispatch center located in Building 313 handles all nonsecurity dispatching for the Laboratory. This includes:

- Dispatching fire department units at both LLNL Fire Stations—#1 (Livermore) and #2 (Site 300)

- Serving as the 911 answering point for all Laboratory emergency calls
- Monitoring the site-wide Health and Safety Alarm System
- Operating the Building Emergency Voice Alarm/Notification system
- Serving as the off-hours contact point for off-site response groups located at LLNL, such as the Nuclear Emergency Search Team (NEST), the DOE Accident Response Group (ARG), Radiological Assistance Program, Federal Radiological Monitoring and Assessment Center, and Threat Credibility Assessment.
- Receiving and dispatching requests for mutual aid for the Twin Valley Area and throughout Alameda County
- Dispatching and tracking the off-hours Hazards Control H&S Technician
- Coordinating the fire protection system impairment control process for LLNL buildings
- Receiving requests and dispatching personnel
- Serving as the primary contact point for the Laboratory Emergency Duty Officer (LEDO).

### Special Projects Division

The Special Projects Division has 49 employees. SPD is a multidisciplinary team of scientists and technicians that provides solutions to current and anticipated health, safety, and environmental problems. This division maintains specialized expertise and facilities to identify problems, define and develop solutions, and provide transitional support for the implementation of new technologies.

The SPD supports the HCD and Laboratory programs at LLNL through regular interactions with

ES&H Team Leaders and discipline contacts. SPD serves as a technical resource for the DOE and other government organizations and participates in the development of national and industrial standards. The division performs basic and applied research in the disciplines of Fire Safety, Industrial Hygiene and Safety, Radiation Safety, Explosive Safety, Environmental Protection, and other safety-related sciences. SPD also has oversight responsibility for the HCD Management Information System Team (MIST), which is tasked with the development and maintenance of the various computer programs and databases that contain employee safety and health records.

### Education, Training, and Safety Analysis Group

The Hazards Control Education, Training, and Safety Analysis Group (ET&SAG), with 29 employees, has three primary functions. First, ET&SAG instructs Lawrence Livermore personnel about safety and health hazards, regulatory requirements, and additional LLNL management controls that are required to safely conduct hazardous activities. This division also teaches practical solutions for responding to and controlling hazards.

Second, ET&SAG provides the technical expertise needed to conduct formal quantitative hazard analyses of LLNL operations and facilities and acts as liaison with DOE personnel to reach agreement on the required format and content of these analyses.

Third, the ET&SAG operates the Safety Glasses Office and manages the Safety Shoes contract for LLNL. These activities include dispensing prescription and nonprescription impact safety glasses, laser safety glasses, computer workstation glasses, and safety shoes to LLNL and some contract employees.

### III. Department Accomplishments—1995

The major accomplishments of the Hazards Control Department for the calendar year 1995, as summarized below, reflect the department's commitment to the APP. The emphasis here is upon the non-routine institutional, programmatic, and external achievements, rather than on regularly performed, routine tasks and activities.

#### **Audits, Oversight, and Monitoring of Corrective Actions**

##### **ICF Decommissioning Project**

An Industrial Hygienist traveled to the Inertial Confinement Fusion facility in Ann Arbor, Michigan, on several occasions to support the facility decommissioning project there. The hygienist planned and conducted the final hazardous materials survey, including the collection of mercury vapor, surface RCRA-metal, polychlorinated biphenyl, and volatile organic vapor samples. Results of the survey were used to release the facility for general use.

##### **Review of DTED Programs**

A Health Physicist participated in a review of two Defense Technologies Engineering Division (DTED) programs [W-48 Cracked Pit Cleanup and Dimethyl Sulfoxide (DMSO) Dissolution Workstation] conducted by the Defense Nuclear Facility Safety Board (DNFSB). In general, DNFSB was very pleased with the DTED programs and the integration of safety into the planning and execution of these programs.

##### **Certification Panel for BEEF at NTS**

Two Explosive Safety Engineers were appointed by the Deputy AD for Nevada Experiments and Operations to serve on a certification panel for the Big Explosives Experimental Facility (BEEF) at NTS. Certification tests were completed, including a 25% overtest (7,788 lb of TNT). A report was written by the panel to document the certification of this facility for manned operations.

#### **Root-Cause Identification, Risk Assessment, and Control**

##### **Review of SAR and FSP for the Plutonium Facility**

ES&H Team 1 provided substantial contributions to the preparation and review of the Plutonium Building's Safety Analysis Report (SAR) and the triennial review of the Facility Safety Procedure (FSP). The SAR was approved by DOE and is the first Category 2 Nuclear Facility in the DOE Complex to have an approved SAR that meets DOE Order 5480.23 requirements.

##### **Reconfiguration of the Tritium Facility**

Team 1 assisted with the reconfiguration of the Tritium Facility to provide a state-of-the-art, low-level tritium and radioactive waste R&D capability. This focuses in the near term on legacy waste and decontamination projects, and also serves to maintain and nurture LLNL tritium expertise. In the near future, the facility will support low-inventory tritium experiments to a 5-g facility maximum and host selected non-tritium, low-level radioactive waste activities.

##### **Upgrade to the Criticality Alarm System in B332**

Team 1 spent a significant amount of effort working on the Criticality Alarm System upgrade in Building 332. The Criticality Safety Engineer presented the implementation plan to facility residents and participated in the development and execution of the *in situ* test plan. The changeover from the old to the new system has been successfully completed.

##### **Review of Main Charge Explosive Component Manufacturing Proposal**

Team 1 provided a significant amount of effort in reviewing documentation and preparation of the DOE-supported LLNL proposal to manufacture main charge explosive components at the Site 300 Process Area for LLNL-designed weapons systems. There is considerable political controversy concerning whether explosives main charge manufacturing should be performed at Site 300 or the DOE Pantex



Plant in Texas. A final DOE-HQ decision is expected to be announced in early FY97.

### **Preliminary SAR for NIF**

ES&H Team 2 coordinated and provided significant input and analysis into a preliminary SAR for the National Ignition Facility (NIF). The Division Leader for Team 2 is also an *ex officio* member of the NIF Assurance Working Group, which has oversight of the various environment and safety issues associated with the design, construction, and operation of this \$1.3 billion facility. The team also contributed to the production of the NIF Environmental Impact Statement and Conceptual Design Report. Team 2 plays a key role in the review of NIF designs in order to identify and resolve ES&H issues as early in the process as possible. The team Health Physicist is providing direction in concert with the external Architectural and Engineering firm on the design of the ionizing radiation shielding for the Laser Area and Target Bay Facility, which will be approximately one football field wide, two long, and six stories high.

### **Fire Protection System at Device Assembly Facility**

A Fire Protection Engineer led a team from LLNL and Los Alamos National Laboratory (LANL) in a site visit to the Nevada Test Site (NTS) where they provided technical consultation, peer review, and a final report on the Fire Protection System at the Device Assembly Facility at NTS. The Fire Protection Engineer took the lead in drafting the report, which includes installation and quality control issues observed by the team and recommendations for short- and long-term mitigation. His expertise continues to be sought by stakeholders at NTS, LANL, and Lawrence Livermore.

### **W-55 Dismantlement Activities**

In early July 1995, members of Team 3, including the Team Leader, Deputy Team Leader, Health Physicist, Industrial Safety Engineer, Industrial Hygienist, and Explosive Safety Engineer, attended a W-55 Pre-Online meeting at Sandia National Laboratories/New Mexico (SNL-NM). From July 11–20, the Health Physicist, Industrial Hygienist, and Explosive Safety Engineer were at the Pantex Plant for the W-55 Trainer QED. The Health Physicist from

Team 3 and the Explosive Safety Engineer from Team 1 participated in the week-long W-55 WR QES.

### **Industrial Hygiene Support**

Industrial Hygiene exposure assessments are performed to anticipate, recognize, evaluate, and control potential workplace health hazards so that all employees are assured of a safe and healthful work environment. In April 1995, an *Exposure Assessment and Monitoring Plan*<sup>2</sup> was published to provide a consistent, systematic framework with which to evaluate and respond to workplace conditions. During 1995, only 3 worker exposures exceeded the Threshold Limit Values/Permissible Exposure Limits for hazardous chemicals, physical, and biological agents out of nearly 3,000 measurements made.

### **Radionuclide Sampling System Upgrade**

This upgrade for LLNL radionuclide air effluent sampling systems in several facilities was done to improve compliance with the Environmental Protection Agency (EPA) National Emission Standards for Hazardous Air Pollutants (NESHAP) regulatory requirements. Upgrades involved the design, fabrication, installation, and calibration of multinozzle aerosol extraction probes and multisensor velocity probes. All the probes have been designed, fabricated, assembled, and calibrated.

### **W-79 High Explosives Dissolution Workstation**

SPD provided support on the design, fabrication, and testing of the ventilation system for the workstation. The division established criteria for the ventilation design, conducted flammability studies in DMSO aerosols, and conducted studies on DMSO purging.

### **Full-Scale Fire Testing of Flammable Waste Drum Storage Areas**

This project provided information on the fire performance of sprinklered waste drum storage areas that contain flammable and mixed flammable liquids in 55-gal drums. SPD conducted two full-scale fire tests with the following results: (1) the sprinkler in an open-sided structure might not activate quickly enough to prevent drums from failing; (2) wooden pallets present a reignition hazard during postfire operations; and (3) banding palletized drums stacked two-high helps prevent them from falling or toppling during a fire.

### **Stockpile Dismantlement Database**

For a Weapons project, SPD helped develop a spreadsheet format that includes all the parts found in LLNL-designed weapons. SPD was given information for each part, including its chemical and physical properties, its toxic, flammable, radioactive, and explosive hazards, and recommended personnel protection. SPD also entered information into the existing Stockpile Dismantlement Database (SDDB) designed by SNL. The division assembled six spreadsheet booklets for this project and sent them to the Pantex Plant. SPD also completed input into the SNL SDDB on six LLNL designs and characterized additional military parts per a DOE request.

### **Safety Analysis Activities**

A five-year effort in the development of safety basis documentation for the entire Laboratory was completed during 1995, with the exception of documentation for Site 300 that is scheduled for completion in the summer of 1996. Progress by ET&SAG was recognized in the UC/DOE Contract Performance Management assessment when DOE/OAK awarded a score of 80% on PM 4.1.a "Risk Assessment." Completion of the five-year effort was greatly aided by the successful negotiation of an agreement between HCD and DOE/OAK to allow the documentation of existing "Low Hazard" facilities in a Preliminary Hazard Assessment (PHA) rather than a SAR. This agreement has saved LLNL more than \$1 million.

### **Management Commitment and Involvement**

#### **Support for Off-Shift H&S Technician Program**

ES&H Team 1 continued to manage and provide administrative support for the Off-Shift H&S Technician Program. This program has two dedicated technicians from Team 1 and also uses specially qualified H&S technicians from all four ES&H Teams. The program provides routine, special, and emergency support at LLNL from 4:45 p.m. to 8:00 a.m., Monday through Friday, and all day and night on weekends and holidays. During 1995, the Division Leader for ES&H Team 1 nearly completed transferring the entire 4.5-full-time equivalent employee (FTE) support effort from HCD overhead funds to the Laboratory programs that use this off-shift support.

### **Human Resources**

The Administrative Services Division established a new Mentoring Program and provided training to current mentors and protégés. In 1996, the mentoring committee will make a presentation to the EPD senior staff and the LLNL Diversity Working Group about how to establish a mentoring program.

The division placed the following human resources information on the HCD file server, Baloo, in 1995:

- An improved version of the workforce report that includes a spreadsheet to track present and historical headcount and FTE levels
- A current department organization chart
- Hiring and posting forms
- Position description form
- Brokering folder
- Names of HCD employees who currently serve as members or officers of national boards and commissions and their terms of office.

### **Wellness**

A Wellness event was successfully planned for the department by the HCD Health Awareness Team and ES&H Team 3. It was a noontime picnic, paid for by the employee fund, that included healthful food and many other health and wellness activities.

### **Facilities Activities**

Trailer 3275 was moved from Fire Station #1 to a site just east of Trailer 2526 and renumbered T2530. The trailer is used primarily by SPD.

The design of the Building 254 addition for the General Plant Project (GPP) was completed and construction has begun.

The final Plant Engineering (PE) design for installation of the new Vehicle Radiation Monitoring system was approved. The site is along Westgate Drive. It has a traffic turnout that will be shared by vehicles to be monitored and a bus pick-up point.

Three fume hoods and exhaust systems were installed in Building 255. These are used by SPD and, temporarily, by the Bioassay Laboratory during construction of their new building.

At the request of the EMD, a design was developed for a patio/physical activity area south of Fire Station #1 on the site of the temporary trailer area.



Noontime picnic and Wellness event sponsored by the Administrative Services Division.

The new design is consistent with the building layout plan and the plan for future parking and landscaping in the area.

An augmented scope (Blue Book) was completed for a proposed 1995 GPP to replace Fire Station #2 at Site 300. The AD for Defense and Nuclear Technologies supports the S300 Fire Station/Medical Facility Project for FY98 funding as a first priority project. HCD will resubmit the project for FY98.

HCD contributed to a classified area, core contraction study by the Safeguards and Security Department (S&SD) in cooperation with PE. One of the desired features is the Fifth Street extension to the Inner Loop Drive to open up east-west access across the Laboratory. HCD Trailer 2629 is in the path of that extension. PE has proposed exchanging Trailer 2629 for Trailer 2679. HCD accepted a request from PE Site Planning to exchange HCD trailers 2629, 2626, and 2633 for NAI trailer 2679. The affected groups would be ET&SAG and MIST.

Official ownership of the ES&H Team 4 Trailer was transferred to HCD from the Energy Directorate. This was part of a negotiated agreement involving Energy, Plant Operations, PE, and HCD.

### HCD Institutional Activities

The ES&H leadership role of the department from an institutional standpoint was quite evident in 1995, as HCD played a major part in the successful development of the following:

- DOE Pilot Oversight Program of the three UC-operated national laboratories—LLNL, Lawrence Berkeley National Laboratory (LBNL), and LANL

- DOE Integrated Safety Management System
- Appendix F of the UC/DOE contract for LLNL that contains the Performance Measures by which DOE assesses UC's management and operation of LLNL.

### HCD External Activities

HCD personnel remain active in many national and international organizations and committees that have a direct impact on the standards and requirements that affect LLNL, including the following:

- International Society for Respiratory Protection—President 1995-1997
- American Society for Testing and Materials, F-23 Committee on Protective Clothing—Vice Chairman 1995-1997
- American National Standards Institute (ANSI), Z88 Secretariat—Ongoing Chairman; Writing group for an ANSI standard on "Emergency Response to Criticality Accidents"; Rewrite Committee for American National Standard of Radiation Protection Instrumentation Test and Calibration ANSI N323-1978—Member; ANSI Z-13 Committee on "Radiation Protection"—Member; ANSI Z-42 Committee—Member; Chairman of the ANSI 13.43 Working Group on anthropometric phantoms. This work will help establish appropriate standards for the use of human surrogate structures in the measurement of internally deposited radionuclides.
- National Institute of Occupational Safety and Health, Worker's Family Protection Task Force—Member, September 1994–June 1998
- Board of Directors of the American Industrial Hygiene Association (AIHA)—1995–1998; Member of three AIHA committees—Biological Monitoring, Gas and Vapor Detection, and Laboratory Accreditation
- Member of the International Commission on Radiological Units Working Group on "The Determination of Internally Deposited Radionuclides." This group will define appropriate methods for the measurement of internally deposited radionuclides.
- Member of several National Fire Protection Association (NFPA) Committees: Structural Fire Fighting Protective Clothing and Equipment, Respiratory and Personal Alarm Equipment, Fire and Emergency Services Protective Clothing and

Equipment, Laser Fire Safety, Fire Service Training, Water Mist Fire Suppression, Computer Protection, Construction and Demolition, and Fire Service Occupational Safety and Health

- Membership in the Health Physics Society (HPS); HPS Standards Committee—Chairperson, External Dosimetry; Membership on the HPS Environmental Pathway Modeling Working Group
- Participant of the Office of the Joint Chiefs of Staff and the Office of the Under Secretary of Defense for Policy, Emergency Planning Directorate, Partnership for Peace International Program
- The ARG Assessment and Evaluation of Nuclear Weapons Accidents—Chairperson of Working Group
- Predictive Modeling (HOCWOG 41F) Working Group
- Committee for “Procedures and Instrumentation for Characterizing Airborne Radioactivity in the Workplace,” PLANCO 57 (soon to be an ANSI Standard)—Chairperson
- DOE Industrial Hygiene Laboratory Directors’ Working Group—Founder and Chairperson
- Accident Response Capabilities Coordinating Committee—Member of the H&S Working Group and the Chairperson of the Mobile Laboratories Sub-Working Group
- DOE Explosive Safety Committee—Member
- National Council on Radiation Protection, chartered by the U.S. Congress to make recommendations regarding radiation protection standards and practices in the United States—Member
- American Conference of Government Industrial Hygienists (ACGIH)—Chairperson.

## Solutions Through Innovation and Creativity

### Categorization of Chemicals for Impoundment

Team 1 helped to coordinate Lawrence Livermore’s response to a Notice of Violation received from the Central Valley Regional Water Quality Control Board because of a leaking explosives process waste water impoundment. They assisted the Chemistry and Materials Science

(C&MS) Division and Site 300 management to categorize chemicals shown on the composite chemical list according to their compatibility with the surface of the impoundment liner. This allowed the defense of liner compatibility using literature, rather than actual testing.

### Reuse of Enclosed Hazardous Materials for DUS

ES&H Team 3 provided support for excessing equipment to Donation, Utilization, and Sales (DUS) from Buildings 235, 241, and the 222 Complex. Team 3 Industrial Hygienists and Health Physicists developed agreements on hazardous materials that are part of usable lab equipment (e.g., enclosed asbestos insulation in scientific ovens). Now working equipment can be sent out intact for reuse (as opposed to being destroyed in the effort to remove hazardous materials that presented no exposure concerns).

### Waste HEPA Filter Sampling Project

Team 3 worked very closely with the Environmental Analytical Services Sampling Group in C&MS to get the Waste High-Efficiency Particulate Air (HEPA) Filter Sampling project (OSP 222.161) under way. The Industrial Hygienist provided hands-on specific training on the controls and work practices for the samplers. The Team 3 Health Physicist provided the safety briefing for the radiological hazards. This project will help Hazardous Waste Management (HWM) reduce the inventory of these filters, which are out-of-compliance hazardous waste (i.e., over one year in the HWM facility).

### W-79 Dissolution Workstation

Team 3 reviewed the final design of the W-79 Dissolution Workstation. The first of several W-79 Dissolution Workstation boxes was shipped to the Pantex Plant in mid-July. Team 3 safety professionals with expertise in Explosives Safety, Health Physics, Industrial Hygiene, and Industrial Safety and Fire Protection worked with the Pantex Plant and safety personnel to ensure that the workstation was properly identified and met Pantex acceptance criteria.

### Student and New Hire Safety Orientation

Team 3 assisted the Physics & Space Technology Directorate in the development of an innovative summer student/new hire safety program that is being emulated by other directorates and ES&H Teams. In this program, ES&H professionals from Team 3 give orientation tours of Lawrence Livermore for students

and new hires. The program was initiated in response to a recommendation that was made after a 1993 accident that involved two students.

### **Budget and Financial Information Enhancements**

The Administrative Services Division placed the following management information on the HCD file server, Baloo (located in the HC Appletalk zone):

- Current and projected HCD budget itemization
- A newly developed spreadsheet for tracking the annual capital equipment budget.

This division developed HCD procurement policies that allow for Lawrence Livermore's increasing use of the Procard. These policies allow HCD employees to purchase items quickly using Procard and, at the same time, maintain a certain level of financial oversight over department spending. All HCD Procard holders (approximately 12) are members of the Procurement Team, and the policies were developed by members of the team.

ASD improved HCD budget projection methods in 1995. In the normal budget process, projections are based upon Cost Analysis Reports from Administrative Information Systems after making small changes based upon unusual fluctuations in average costs anticipated by the Division Leaders. In the new method, each division enters its costs from the previous month from the Detail Ledger and any expected costs for the following months into a spreadsheet. More accurate department cost projections are the result. Projections derived from both methods shows large variances from the plan early enough to make meaningful adjustments.



Belarus mobile laboratory designed and built by the Special Projects Division.

The division developed an enhanced Work Budget Elements (WBEs) to Work Breakdown System that makes each WBE self-contained. All of the items needed for a function are incorporated into a single WBE. Previously, new WBEs could be developed as dependent elements of a larger WBE. The problem with the earlier system was that eliminating a high-cost WBE during prioritization would cause the loss of a low-cost WBE function dependent on it.

### **Assurance Activities**

ASD worked with the SLD to successfully downgrade the classification of Building 255 from a Nuclear Facility to a Radiological Facility. This building now houses the Special Projects Division.

### **Fire Protection Support**

In 1995, Lawrence Livermore developed a plan to phase out the use of fire protection Halons, beginning with those used in portable fire extinguishers and fixed fire suppression systems. This managed process includes interim measures to prevent inadvertent discharges of Halon to the environment until the Laboratory's inventory of Halon systems can be replaced with acceptable alternatives.

### **New Analytical Method**

The Bioassay Laboratory developed a new method for analyzing urine samples for neptunium, uranium, and thorium.

### **SLD Activities**

SLD distributed the Hotspot Health Physics codes to the Ukraine and Kazakhstan.

The SLD Division Leader was a participant in the Russian Highly Enriched Uranium Project.

### **Belarus Mobile Laboratory**

HCD, in collaboration with the Non-Proliferation/Arms Control and International Security Directorate (NAI), fabricated a mobile laboratory for the nation of Belarus. The laboratory was specifically designed to monitor radiation from an accident, should one occur, involving dismantlement of nuclear weapons. The mobile laboratory is a dual-axle trailer 12 m long (excluding cab) by 2.4 m wide by 3.8 m high. The trailer also has two self-contained generators for electrical power, heating, and cooling. The trailer contains radiation measurement equipment and supplies necessary for collecting samples and measuring radiation levels. The interior of the

trailer has three rooms: a sample entry and preparation area, supply room/office, and a radiation measurement laboratory. The sample preparation area contains a fume hood, water sink with hot and cold water, hot plates, and counter space for preparing samples before they enter the radiation measurement laboratory. The laboratory contains a liquid scintillation counter, low- and high-energy gamma detector systems, and an alpha-beta gas proportional counter. The trailer is also equipped with a large number of portable radiation measurement devices designed for field measurements of contaminated areas. SPD is now focusing its efforts on developing highly portable, all-terrain, emergency transport and response laboratories.

### Health and Safety Training Activities

#### Classroom instruction:

- Hazards Control has been active in upgrading H&S classroom training through the improvement of visual aids, the preparation of several short refresher courses, and the addition of new audio-visual technology to the classroom.
- Many of the viewgraphs used in courses that originated some years ago had become damaged with use and typically did not employ color and graphics to help improve visual interest. Trainers worked with subject matter experts who are the instructors in these courses to "sharpen" their message, making the viewgraphs less cluttered and easier to read and adding graphics and color to improve emphasis on the most important points of the presentation. Student response to these changes has been good.



Students in a Health and Safety CBT training class.

- A common complaint from personnel required to take the same course periodically in order to remain qualified is that they need only a short refresher course, not the original introductory course. This year, several refresher courses were developed by the trainers for the instructors. Typically, the refreshers are no more than half the length of the introductory course, saving about 50 labor hours per class. In the new Radiation Control Technician (RCT) training, the trainers have been especially careful to tailor the course materials in such a way that they can be handed out for preview. Then the technicians can "test out" of the classroom portion. This has been so successful that approximately 4,600 labor hours of classroom training have been avoided. (Even the proposed classroom training is about 3.5 times shorter than the same training presented at other DOE contractor sites.)
- Classroom technology is also changing. Video training and direct electronic projection are now in use for emphasis (including the possibility of motion) and good visual quality, and also to allow comparatively simple modification of material.

#### Computer-based training (CBT):

- HCD purchased computer workstations for individualized training last year. These are specially equipped as multimedia workstations with CD ROM and laser disc readers. Most of the effort this year was directed toward finding commercial or government software that was considered acceptable for LLNL H&S training. It required significant effort to get these workstations on line because each one must be configured for an individual program. To date, there are courses in the discipline areas of Industrial Safety, Industrial Hygiene, and Health Physics, and new courseware is being sought. One CBT course, Laser Safety, so pleased a supervisor from the Laser Programs that he registered all of his personnel, not just the ones required to take it. One course was written for LLNL by a contractor to demonstrate the capabilities of the technology. Several trainers are studying the authoring software so that other courses may be developed in-house.
- So far, students are not demonstrating any time savings in the use of CBT compared to classroom instruction. A charitable interpretation is that they tend to be so fascinated by the software that they go through the whole course even if they know the information. In one case, however, a

student initially complained about having to go through the whole CBT course for a refresher. It was explained that he could test out without reviewing the material and be finished in just 45 minutes. He completed the course in 4 hours, and admitted that he hadn't remembered as much as he thought. The savings is expected to appear when students return for refreshers and take the test-out options.

#### World Wide Web-based training (WBT):

- Hazards Control trainers have been active in applying the new Internet technology to training. This technology is highly user friendly, providing desktop, just-in-time training. Several courses have been prepared and placed on the LLNL Training home page. They are different from the training provided in organizations outside of LLNL because they are interactive and have online testing, as reported at the November Training Resource and Data Exchange (TRADE) conference. TRADE has now included the address of the LLNL Training home page in their list of training sites.

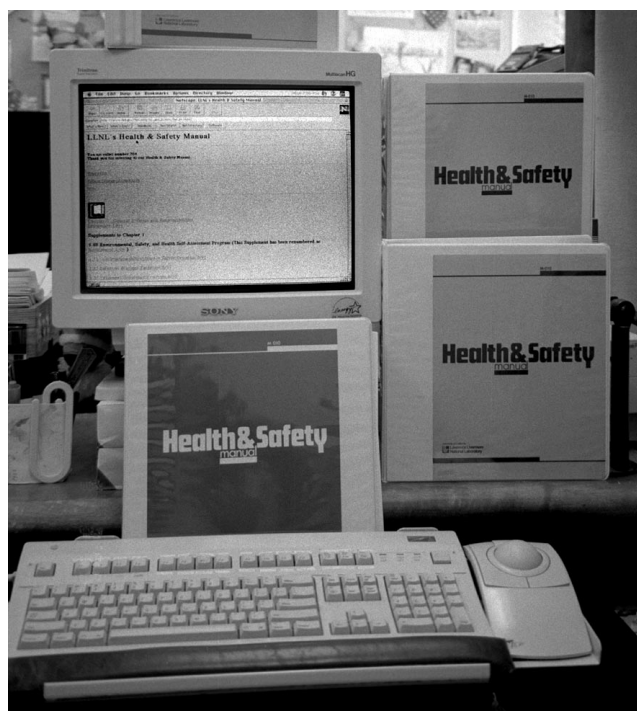
### Simplification of ES&H Elements

#### *Health & Safety Manual*

In 1995, HCD implemented an Internet version of the *H&S Manual* that is hyperlinked to the *Environmental Compliance Manual*.<sup>3</sup> This makes it easier for Lawrence Livermore employees to consult and review ES&H policies and requirements online. By publishing this document online and hyperlinking it to companion documents, HCD has averted an estimated \$2.8 million to develop and publish a combined ES&H manual. Because subject matter in the electronic *H&S Manual* is linked to Occupational Health and Safety Administration (OSHA), DOE, and other documents, users can access the original source of the regulations. Besides being of use to LLNL employees, the electronic *H&S Manual* is accessed by other DOE sites and outside organizations.

#### Fire Protection Support

The Technical Leader for Fire Protection Engineering was appointed to a three-year term on the Member Advisory Council of the NFPA. As a member of the council, he will be responsible for reporting directly to the association management and board of directors in matters of membership feedback, suggestions for improvements in the delivery of



The *Health & Safety Manual* is now available on the Lab's Internet Home Page.

NFPA services to its customers, and to serve as a goodwill ambassador for the NFPA.

The LLNL *Fire Protection Program Manual*<sup>4</sup> was completely revised, targeting a wider audience that now includes managers, facility engineers, assurance managers, building coordinators, and ES&H Team members in addition to fire protection program staff members. This latest revision incorporates the use of icons to identify sections of interest to various user groups, such as facility-related specialties or fire protection staff.

#### Radiation Protection Support

Members of HCD spearheaded an effort among the DOE contractors to convert the DOE *Radiation Control Manual (RCM)* from a compliance document to a guidance document. After a year and a half of effort, and with the support of the University of California Office of the President, LANL, and LBNL, the effort was successful. The change of status will allow the RCM to be implemented in a cost-effective manner at LLNL and at other DOE contractor sites as well. The cost averted is estimated to be \$2 million per year at LLNL alone.

Lawrence Livermore received final approval from DOE for the six exemptions requested from 10 CFR

835. The approval of these exemption requests has been incorporated into the electronic version of Supplement 33.02 to the *H&S Manual*, which is the primary implementation document for 10 CFR 835 at LLNL. These exemptions saved Lawrence Livermore over \$250,000 on implementation costs.

### Training Development

In support of the DOE/Environmental Management (EM) Office, SPD was tasked with developing standard courses and course material for required DOE training. SPD provided DOE with a list of information including course objectives, intended audience, duration, evaluation type, and the names of contacts for over 150 training courses received by SPD from vendors, universities, and other DOE contractors and facilities. These courses cover some 19 technical areas ranging from organizational activities to engineering, geology, and hydrology. These courses are being evaluated for specific applicability to environmental management activities by SPD staff and others throughout DOE. EM intends to use this information to assist in the technical qualification program for EM employees and to provide a service to the rest of DOE. Information received as a part of this project is presented on the EM Training and Education Home Page under the category "other courses." The Internet address is <http://www.em.doe.gov/emtrain/index.html>.

### Development of NFPA Standard 115

A Team 2 Fire Protection Engineer was a member of the Technical Committee on Laser Fire Protection, a principal member of NFPA, and was actively involved in the development of NFPA Standard 115, *Recommended Practice on Laser Fire Protection*. This standard was officially issued by the NFPA on July 21, 1995.

### Necessary and Sufficient Task Force Activities

ES&H Team 4 supported the Health and Safety Subgroup of the Necessary and Sufficient Task Force. This subgroup was co-chaired by Steve Carr, Division Leader for ES&H Team 4, with the assistance of SPD staff. Team support included a Health Physicist, Industrial Hygienist, Industrial Safety Engineer, a Safety Analyst, and an Administrative Specialist. A final draft of the Necessary and Sufficient ES&H Standards was issued for the HWM Project and was forwarded to the External Confirmation Team. In addition, several members from LLNL participated in a Necessary and Sufficient "Lessons Learned" Session sponsored by the DOE/Chicago Operations Office.

### ES&H Guide for the Safeguards and Security Department (S&SD)

Team 4 worked on the ES&H Guide for S&SD. This document, which is due for completion in the first half of 1996, is based on the LLNL *H&S Manual*. It is a compilation of the relevant ES&H procedures and practices that apply to S&SD activities.

### OSPs for Long- and Short-Term Facility Shutdowns

Team 4 supported the Legacy Facility Task Force in developing generic Operational Safety Procedures (OSPs) for both the long-term and short-term shutdown of facilities not containing process contamination. These procedures would be especially useful for permanent closure of office trailers and like facilities when there is little or no expectation of unusual contamination (e.g., radioactivity, beryllium, PCBs).

### Electric and Magnetic Fields Program for the California PUC

A Team 2 Industrial Hygienist has participated on the Stakeholders Advisory Committee since September of 1995 and has been appointed chair of the committee for 1996. This committee advises the State of California's Electric and Magnetic Fields Program, which develops policy options for dealing with concerns about the potential hazards of power-line fields. It is managed by the California Department of Health Services for the Public Utilities Commission (PUC).

### Emphasis on Real ES&H Issues

#### Support for USAF Peacekeeper Flight Tests

Under the auspices of ES&H Team 3, the Deputy Division Leader for ES&H Team 1 provided on-site safety support to the Air Force Flight Systems Test Group for Peacekeeper Flight Tests at the Kwajalein Missile Range. This support will continue in 1996.

#### Support for W-79 Dismantlement at Pantex

Eight H&S Technicians from HCD supported the W-79 Preparation for Dismantlement at the Pantex Plant. The technicians traveled to Pantex for two-week assignments every six weeks. They were required to maintain their Personnel Assurance Program and limited plutonium handler status as well as remaining current on Pantex-required site-specific training. The Team 3 Health Physicist acted as the H&S contact for this project, holding regular meetings with the H&S Technicians, ensuring that



safety equipment such as radiation survey instrumentation and dosimetry were available to crews, and responding to several unusual occurrences.

### **Decontamination of Former Test Program Laboratories in B151**

H&S Technicians from ES&H Teams 2 and 3 cleaned up and decontaminated five former test program laboratories in Building 151. These laboratories and their contents were surveyed for radioactive contamination. After completion of the surveys, the laboratories were retrofitted to receive the occupants from Building 281.

### **Fire Protection Support**

Fire Protection Engineering continued to actively participate in the development of DOE-prescribed codes and standards through membership on several national and international technical committees of the NFPA.

Fire Protection Engineering led an effort to close many of the outstanding Factory Mutual audit findings using the Equivalency Process. After extensive analysis under currently existing conditions, it was determined that many of the original audit recommendations were either no longer valid or not cost effective. Using an equivalency process developed

by LLNL that was agreed to by Fire Protection Engineering in the DOE/Oakland Operations Office, 12 of the original recommendations for HCD were closed out, thus avoiding unnecessary major expenditures.

### **Radiation Protection Support**

The Laboratory continues to make an aggressive effort to minimize occupational radiation doses to its employees. Beginning in 1993, this effort was incorporated into the UC Contract Performance Measures. Since that year, the collective doses have decreased from 30 to 11 person-rem. Although some of the reduction has been the result of decreased workload, much of the dose reduction is the result of the positive impact of the dose reduction procedures implemented during the inventory reduction effort in the Plutonium Facility.

### **Support for Programmatic Activities**

Team 1 provided significant safety support for ongoing and new programmatic activities. Two new major activities in the High Explosives Applications Facility that required significant ES&H team support included the Molten Salt Destruction Unit, which is an R&D project for the Department of Defense (DoD) for thermally treating explosives waste, and the LLNL Detonator Surveillance Program, which was transferred to the Laboratory from EG&G Mound.

### **Laser Guide Star Installation at Lick Observatory**

Team 2 supported the Laser Guide Star installation at the Shane Telescope at Lick Observatory, which is a UC facility. Team members made several trips to Lick to review the proposed installation, provide laser safety training to Lick personnel, design fire protection for the installation, and evaluate microwave radiation levels throughout the Shane telescope dome while the aircraft intrusion detector radar mounted adjacent to the Guide Star laser assembly was operating.

### **LLNL Policy for Refrigerants**

A Team 2 Industrial Hygienist drafted a Laboratory-wide policy for refrigerants. This effort was driven by the concerns of PE employees about the possibility of a refrigerant leak creating dangerous conditions in the basement of Building 490. The policy was issued to assure that refrigerant issues are handled consistently throughout the Laboratory. ES&H Team 4, the EMD, and PE were also involved in the development of this policy.



An ES&H Technician is being checked by another team member before entering a hazardous area.

## **Two-Way Communication, Trust, and Perverserance**

The LLNL Pressure Safety Manager chaired a DOE contractor and private industry Pressure Safety workshop December 5–7 at the Research Drive Training Facility. Over 75 DOE contractors, private company personnel, and vendors attended. The workshop provided Lawrence Livermore with an opportunity to see what other DOE contractors and private industry are doing and the new products available.

A TSPD Explosive Safety Engineer arranged the agenda and served as Program Chairman for the 34th DOE Explosives Safety Engineering Conference, hosted by Lawrence Livermore from May 10–12. Presentations were given on explosives safety, explosives waste disposal, and environmentally related topics. Approximately 60 DOE contractors and DOE Operations Office representatives attended.

Explosives safety experts participated in negotiations with DOE-HQ and UC managers concerning the wording and use of the *DOE Explosives Safety Manual* with respect to the new DOE Order 440.1. The UC position, strongly supported by the Hazards Control Department, was to have the *DOE Explosives Safety Manual* referenced in DOE Order 470 as a non-mandatory (rather than mandatory) technical standard. This was not supported by other DOE contractors and DOE representatives. However, DOE contractors were given significant flexibility concerning the manual's applicability to R&D operations.

## **Record Keeping**

### **Quality Assurance**

HCD developed and completed a Quality Assurance Plan, with implementation plans at both the department and division level.

The department also provided information about recent successful quality efforts to the AD for Plant Operations for presentation to the DOE Quality Council. The AD used three of the four projects submitted by HCD in the presentation.

### **Radiation Protection**

Members of HCD worked closely with program personnel to develop the LLNL *Radiation Protection*

*Plan (RPP)*<sup>5</sup> required for the implementation of 10 CFR 835, the new federal law on occupational radiation protection. This effort involved the development of the customized facility RPPs for each of the seven nuclear facilities and the 60 radiological facilities. This RPP was submitted to the DOE as required in December 1995.

## **Recognition of Quality Work and ES&H Excellence**

### **National ACGIH Award**

A Team 4 Industrial Hygienist, David Zalk, was honored with a National Award from the American Conference of Governmental Industrial Hygienists. David is the recipient of the John J. Bloomfield Award. This award was established in 1978 and is presented annually to an Industrial Hygienist who has made significant contributions to the profession by pursuing occupational health hazards, primarily through field work. The Bloomfield Award recipient is invited to serve as a special guest member of the Board of Directors for one year, followed by a one-year term on the ACGIH Chemical Substances Threshold Limit Values Committee and a subsequent one-year term on the Industrial Ventilation Committee.

### **Edgar Monsanto/Queeny “Safety Professional of the Year” Award from ASSE**

A Team 4 Industrial Safety Engineer, Steve McConnell, received the Edgar Monsanto/Queeny Safety Professional of the Year award from the San Francisco Chapter of the American Society of Safety Engineers (ASSE). The award is sponsored by the Bullard Company. In addition, Steve was named 1995 Safety Professional of the Year for Region One of the ASSE, making him eligible to compete for the national honor.

### **1993 Weapons Recognition of Excellence Awards**

On August 16, 1995, Admiral Beers presented 1993 Weapons Recognition of Excellence awards to six Hazards Control personnel. Those from Team 1 receiving awards were Jim Lewis, radiological control support; Joe Schmitz, radiological control support; and Dave Prokosch, explosives safety support. Those from Team 3 were Peter Baylacq, Pantex Tri-Lab

Office; Patricia Billy, FSP/OSP Coordinator; and Albert Celoni, Division Leader, ES&H Team 3. The awards are for their outstanding contributions as part of the W-48 Cracked Pit Cleanup Team that completed its operations successfully in January 1993.

### Radiation Safety Training

The technical leader for the Calibrations and Standards Laboratory (CSL) is the subject matter expert on portable radiation safety equipment for other HCD organizations. During 1996, CSL provided technical expertise, documents, and training in support of the Belarus Mobile Laboratory. Similar expertise was supplied to the ET&SAG in assembling the job performance measure training guides for all radiation survey meters in use at LLNL.

### Radiation Instruments and Calibration

CSL evaluated and purchased two new types of training survey meters for ET&SAG. One type uses a remote control to dial-in survey meter response; the other uses a radio frequency source to simulate radiation.

In support of the LLNL project at the Pantex plant, the CSL provided procedures and training for equipment calibration both at LLNL and at Pantex. The alpha survey meters and continuous air monitors from LLNL were serviced by Pantex calibration technicians, using CSL procedures.

With funding from DOE (DP-3) and help from SPD, information about the CSL was first uploaded onto the Internet under the auspices of the Health Physics Instrumentation Committee, an organization of DOE calibration facilities. The CSL now has its own Home Page that contains instrument inventory data, staffing and organization, and workflow information at the following address:  
<http://www.llnl.gov/HPIC/RADINST/LLNLINST.HTML>.

The CSL also completed the DOE intercomparison testing with instrumentation from Pacific Northwest National Laboratory. Results of the calibration of neutron, beta, gamma, and x-ray measurements were excellent.

### Personnel Dosimetry Projects

Special dosimetry for Lawrence Livermore employees, including CR-39 neutron foils, was provided to support the LLNL efforts at the Pantex plant.



The SLD lung-counting system is used to determine the presence of radioactivity in the lungs.

The Personnel Dosimetry Laboratory continues to share resources with LBNL. Lawrence Livermore shares its CR-39 track reader with LBNL, and LBNL shares its finger ring reader with LLNL. The two laboratories also share the cost of development of the personnel dosimetry database system. This system is being developed at LLNL and will soon be running at both laboratories.

### Analytical Laboratory Metals Certification

The Analytical Laboratory was certified by the State of California for metals in drinking water and waste waters.

This laboratory also submitted an application to the Environmental Lead Proficiency Testing Program for accreditation by the AIHA for environmental lead analyses.



Firefighters demonstrating their equipment to a group of young students.

### Fire Prevention Education

EMD was an integral part of providing fire prevention education throughout the Livermore Joint Unified School District. The division cooperated with the City of Livermore Fire Department in implementing the NFPA "Learn Not To Burn" program in local schools. This integrated curriculum teaches fire prevention concepts in all phases of the school program, rather than just during Fire Prevention Week. The EMD is responsible for this program at four schools.

### P-32 Intakes Project

The P-32 Intakes Project at the Massachusetts Institute of Technology (MIT) and National Institutes of Health (NIH) was another interesting SPD project that was highly publicized. SPD assisted in the evaluation of the internal doses received by personnel at MIT and NIH after someone intentionally contaminated food with P-32 in nonradiation areas of these institutions. Both incidents were investigated by the FBI and Nuclear Regulatory Commission, and the assistance provided by SPD was greatly appreciated by all involved.

### Internal Dosimetry Assistance Team

This team was formed to provide assistance to DOE and DOE contractors for the performance of current and retrospective dosimetry, documentation of dosimetry programs, etc. SPD developed an interface for multiple intakes using the computer code

CINDY, and performed retrospective dose calculations for EG&G Mound.

### Beryllium Air Monitor

SPD worked on this project to evaluate the technical utility of Laser Induced Breakdown Spectroscopy instrumentation developed by LANL and to implement a plan for commercialization and instrument production. A potential commercial partner was identified and specifications for the commercial instrument were generated.

### Occupational Safety and Health Support

In support of the DOE/Defense Programs Office, SPD engineers worked to provide technical support on environment, safety, and health matters. SPD provided technical training in safety disciplines to DOE staff and management, generated monthly status reports and occasional safety information notices highlighting important ES&H issues, issued technical reviews of existing and proposed ES&H regulatory concerns, provided technical support to DOE on ES&H planning issues, and participated in DOE ES&H strategic plan development and review.

### NEST Support

A group of SPD and other HCD staff developed the Hazards Analysis and Safety Assessment (HA&SA) for the 1995 NEST Training Drill (JIGSAW-95). The drill, which was conducted as a readiness activity by Nevada Test Operations and NAI, occurred during the week of December 4, 1995, at Area 27 NTS. It included over 100 DOE technical and DoD Explosives Ordnance disposal personnel and was witnessed by members of the DNFSB staff. The drill utilized a simulated nuclear device that contained special nuclear material. The HA&SA, which was developed during mid-September to early November, covered the assembly and disassembly of the device as well as an analysis of the potential hazards associated with the drill. The project was completed on time and did not receive any comments or questions from the DOE/Nevada Operations Office during the approval process. NAI, DOE, and DoD stated that JIGSAW-95 was highly successful and greatly contributed to the readiness of the NEST personnel and operations.

In September 1995, the SPD, members of ES&H Teams, and other HCD personnel participated in the week-long Display Select exercise in the State of

Virginia in support of NEST efforts for the Emergency Response Program. HCD personnel were heavily involved in the year-long planning for this exercise, and during the actual exercise were players and served as controllers/evaluators.

## Measurement and Feedback to LLNL

### Industrial and Explosive Safety Support

In 1993, HCD identified the top three injury types and initiated a campaign to reduce their frequency and severity. The three types were repetitive motion injuries at workstations, overexertion injuries to backs, and other overexertion injuries. The reduction in frequency and severity of these injuries was also identified as a UC Contract Performance Measure. A benchmark was established for these injury types by reviewing data from 1991 through 1993. In the initial phases of the corrective action plan developed to reduce these injuries, HCD acted as a catalyst to increase management and employee awareness. HCD has performed more than 500 workstation evaluations per year since 1992, conducted ergonomics safety training classes, prepared *Newsline* articles, and evaluated new ergonomic equipment. These efforts have significantly decreased the severity rates for these repetitive motion injuries. In 1995, the severity based on lost and restricted workdays decreased by a factor of 2 from 1993.

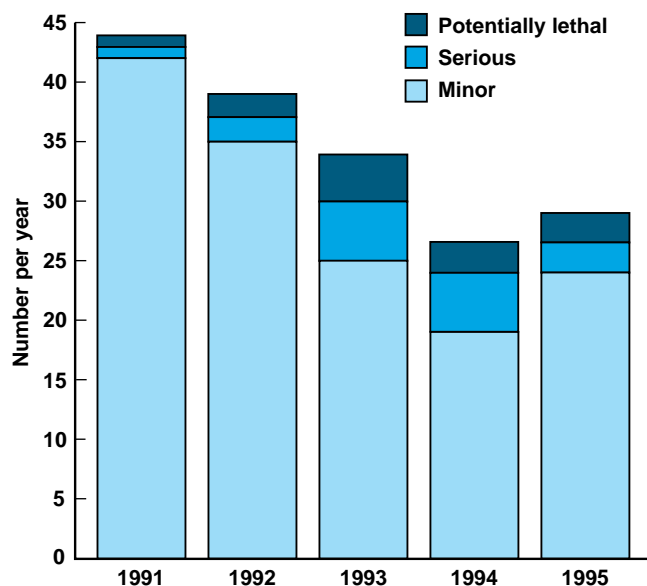


Figure 3. Electrical shocks at LLNL.

The total number of reported electrical shocks has been decreasing for the past few years. However, as shown in Fig. 3, the number of serious electrical shocks increased during the past two years. In response to this trend, HCD initiated a new campaign to reduce the number of serious electrical shocks. This effort included the development of electrical safety awareness briefings, the publication of several "Lessons Learned" on electrical safety incidents, the development of a draft on-the-job electrical safety training policy and program, revisions to Chapter 23 and Supplements 23.01 and 26.13 of the *Health & Safety Manual*,<sup>1</sup> and development of a new Web-based electrical safety training course. In addition to these efforts, Hazards Control has established a new LLNL Electrical Safety Review Committee that replaces the old Electrical Safety Committee.

### Injury, Illness, and Fire Loss Statistics

This section contains loss statistics for LLNL operations. The injury and illness data cover both UC and supplemental labor employees working for LLNL.

#### Injury and Illness Frequency

Injury and illness statistics from Lawrence Livermore's H&S Program indicate that the number of lost and restricted workday cases per 200,000 person hours [i.e., the number of hours worked by 100 FTEs in a year] has been steadily declining since the first quarter of 1993 (see Fig. 4). Lawrence Livermore statistics also indicate that LLNL has maintained a frequency rate significantly below the U.S. Bureau of Labor Statistics (BLS) five-year average for general industry.

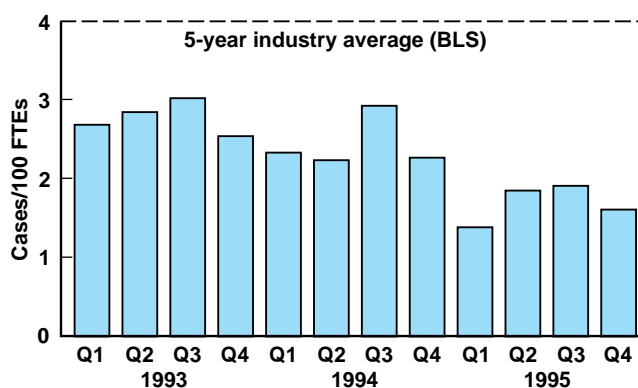


Figure 4. Frequency of lost and restricted workday cases at LLNL per 200,000 person hours.

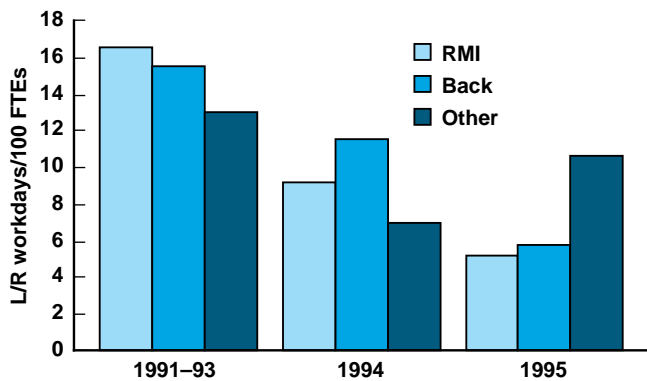


Figure 5. Accident severity rates at LLNL as lost and restricted workdays per 200,000 person hours.

### Injury and Illness Severity

In 1993, HCD identified and focused resources on the top three causes of injuries and illnesses at LLNL (all repetitive stress injuries). The department assisted in the development and then implemented a Lawrence Livermore corrective action plan. Since 1993, LLNL severity rates for these types of injuries have dropped dramatically (Fig. 5).

Figure 6 shows the overall LLNL severity rates for injuries and illness from all causes between 1993 to 1995.

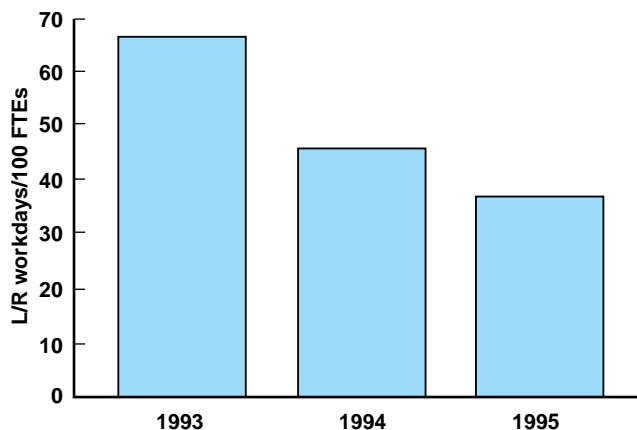


Figure 6. Overall LLNL injury and illness severity rates as measured in lost and restricted workdays per 200,000 person hours (i.e., per 100 FTEs).

### Fire Loss Statistics

The Laboratory suffered no reportable loss due to fire in 1995.

One EMD emergency response goal is a 5-minute total response time to emergency incidents at the SNL-CA and LLNL sites for 95% of the incidents. Figure 7 shows the EMD response record for 1994 and 1995.

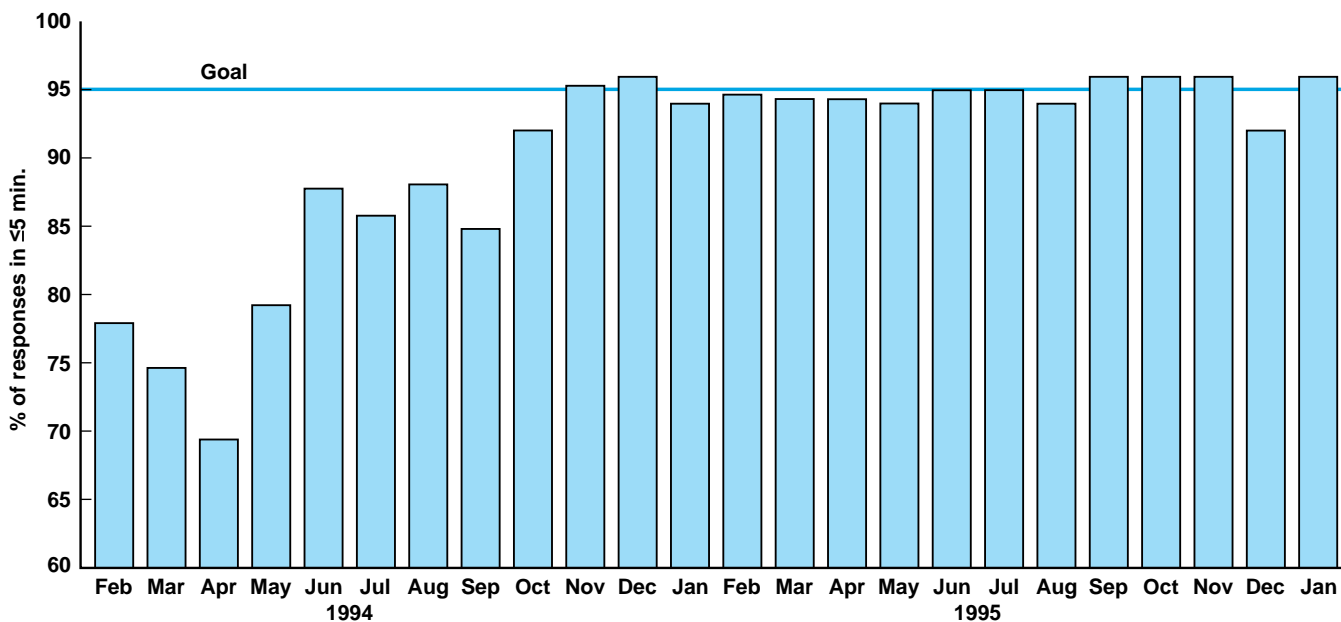


Figure 7. Fire Department emergency response time.

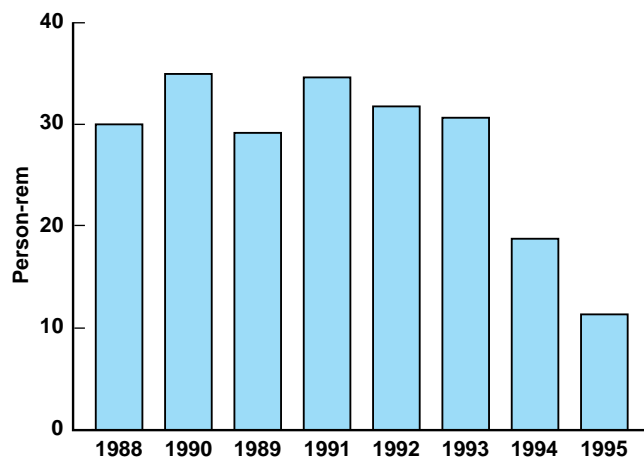


Figure 8. Annual LLNL employee external person-rem data from 1988–1995.

### Ionizing Radiation Trends

Since 1993, the person-rem doses incurred at LLNL have decreased from 30 to 11 person-rem (Fig. 8). Although some of the dose reduction was the result of decreased workload, much of it is attributable to the procedures implemented during the inventory reduction effort in the Plutonium Facility.

## IV. Customer Services

### ES&H Team Services

**Table 1.** Major ES&H Team services and scope of support activities for 1995 at LLNL.

	Team 1	Team 2	Team 3	Team 4	Totals
Gross Program Covered (ft <sup>2</sup> ) <sup>a</sup>	513,360	1,636,403	2,224,097	1,924,261	6,298,121
LLNL Population Supported <sup>b</sup>	590	2713	2934	4586	10,823
<b>Safety Procedures Processed in 1995</b>					
New OSPs	39	8	48	13	108
Canceled OSPs	51	13	87	15	166
New FSPs	5	0	4	1	10
Canceled FSPs	0	0	1	2	3
<b>Active Safety Procedures as of December 1995</b>					
OSP's	128	77	162	50	417
FSPs	12	9	29	12	62
Health Hazards Assessments, Initial Safety Evaluations, or Project Work Plans Issued	30	50	56	100	236
Asbestos Work Permits Issued	7	4	30	41	82
Design Reviews	36	37	103	211	387
Reviews of Supervisor's Accident Analysis Reports	46	130	212	578	966
Number of buildings inspected	14	72	78	112	276

<sup>a</sup>Estimate based on responsibility by Facility AD.

<sup>b</sup>Includes UC-LLNL employees, supplemental labor and other contract employees, visiting staff, and on-site DOE employees.

### Safety Laboratories Division Activities

The number of analyses and other activities performed by SLD in 1995 are summarized below by laboratory:

#### Analytical Laboratory

Analyses 14,000

#### Bioassay Laboratory

Analyses 4300

#### Calibrations & Standards Laboratory

Radiation survey instruments calibrated 2200

#### IH Instruments Laboratory

Instruments calibrated 1000

Instruments repaired 140

HEPA filters tested 450

#### Personnel Dosimetry Laboratory

Personnel dosimeters/monitoring samples evaluated 50,000

#### Radiological Measurements Laboratory

Gross alpha-beta samples analyzed 50,000

Liquid scintillation samples analyzed 8700

#### Respirator Services Laboratory

Clients trained 800

Respirators tested 3200

Filters tested 6100

Respirators processed 10,000

#### Whole Body Counter Laboratory

Whole body counts 480

Alpha spectroscopy 470



## Emergency Management Division Activities

**Table 2.** Incident responses by the Emergency Management Division.

Type	On-Site Emergency Responses			Total
	To LLNL from Station 1	To SNL-CA	To Site 300 from Station 2	
Fire related	416	40	35	491
Ambulance	143	12	7	162
HazMat	75	1	1	77
Service	58	0	0	58
Total On-Site	692	53	43	788
Automatic Aid Calls (Fire) <sup>a</sup>	350	NA	8	358
Automatic Aid Calls (Ambulance) <sup>a</sup>	30	NA	1	31
Mutual Aid Calls <sup>b</sup>	24	NA	0	24
Total Off-site	404	NA	9	413
Total	1096	53	52	1201

<sup>a</sup>A cooperative unconditional agreement to automatically provide reciprocal assistance when called by another fire department.

<sup>b</sup>An agreement to provide assistance to another fire department that is involved in containing a major emergency in their jurisdiction, and which has depleted its fire/rescue resources and needs additional resources in order to handle the emergency.

EMD uses the California Fire Incident Reporting System (CFIRS) to document and report fire experience. This system is a subset of the National Fire Incident Reporting System; information is reported in a standard, comparable format. Table 3 is in CFIRS format. It gives a breakdown of the situations found for fire-related incidents in 1995.

Table 4 lists the buildings with the most frequent demands for service from EMD in 1995. The 14 buildings listed account for 25% of EMD's emergency responses.

**Table 3.** Fire-related incidents reported in 1995.

Situation	Responses (%)
Fire	3
Hazardous condition	4
Excess heat or overheat	8
Odor of smoke	10
System malfunction	10
No cause found	11
Electric arc or short	15
False alarm	19
Unintentional alarm	20

**Table 4.** Buildings at LLNL with the highest service demands in 1995.

Building #	Fire	Ambulance	Other	Subtotals
490	28	4	106	138
332	7	4	125	136
391	17	3	81	101
131	15	5	52	72
511	4	1	63	68
132	15	3	45	63
231	7	3	43	53
551	15	6	27	48
141	8	2	29	39
241	4	0	27	31
121	6	2	21	29
321	7	1	19	27
191	1	1	25	27
222	6	0	20	26
Total	140	35	683	858

### Permits Issued by EMD

A total of 1436 fire permits were issued in 1995 for open flame use. The Fire Permit Program is designed to prevent unwanted fires from any operation that involves an open flame. Fire Fighters inspect each location and issue a permit for the use of the open flame if the operation meets certain safety criteria.

The total number of Fire Control/Alarm Impairment Permits issued by the Emergency Management Division were:

- 733 fire alarm system impairments
- 372 extinguishing system impairments.

These permits were approved and tracked by EMD Duty Chiefs to ensure proper restoration of the systems. This Impairment Control Program is designed to confirm that installed fire protection systems are operational. Fire alarm or detection systems and fire extinguishing systems cannot be placed into any mode except fully operational unless a change in status is approved by the Duty Fire Chief. These impairments are tracked and the status verified daily. Fire department personnel also restore these systems after use to reduce the chances of accidental water damage.

### Fire Prevention Inspections

As part of the EMD fire prevention program, each fire extinguisher, sprinkler system control valve, water supply block valve, and required emergency light is inspected monthly. Inspections ensure that each piece of equipment is in place and in operational condition. Each inspection is documented via bar code reader and records are maintained on a computer system. The equipment inspected during 1995 is summarized in Table 5.

The division also maintain pre-plans for every building at LLNL. These contain key plans, maps, information about utilities and shut-off locations, and

**Table 5.** Fire prevention inspections performed by equipment type.

Type	Inspections /month
Fire extinguishers	3485
Sprinkler valves	836
Emergency lights	285

information about special hazards or high-value equipment. The pre-plans are provided and updated by the H&S Technician assigned to the building. The pre-plans are verified by Division Fire Fighters during each monthly inspection.

### EMD Dispatch Center (B313) Activities

Dispatch center activity is usually measured using the term “demands for service.” That term refers to a transaction that requires the dispatcher to take an action involving dispatching, alerting, or notifying a person, LLNL organization, external agency, or apparatus (e.g., City of Livermore Fire Department). The second measure of dispatch center activity is the number of telephone calls handled, including 911 emergency calls. Telephone calls may be a demand for service or the dispatcher may simply provide information to the caller. Table 6 describes the activity of the EMD Emergency Dispatch Center in 1995 by day of the week.

**Table 6.** EMD Dispatch Center activity in 1995 by day of the week.

Day of Week	Demands for Service	Telephone Calls
Sunday	482	964
Monday	844	2110
Tuesday	1009	2522
Wednesday	1043	2607
Thursday	1029	2572
Friday	926	2315
Saturday	680	1360
Total	6013	14,450

### Cost of Fire Protection

Government property is uninsured for property loss resulting from fire. The ultimate cost of any loss, with or without replacement, is borne by the American taxpayer. This, and the unique and critical nature of many LLNL facilities, places a premium on the effectiveness of Lawrence Livermore fire-fighting capabilities. The DOE philosophy historically has been that it is worth maintaining a high level of emergency response if the cost of providing this service is less than the cost of fire insurance. In order to assure that the Fire Department is cost effective, HCD

**Table 7.** Cost of emergency response in total dollars and as cost of fire protection vs cost of insurance per \$100 value.

Year	Emergency response cost (\$million)	Value protected (\$million)	Insurance cost / \$100 value	Cost of EMD protection/\$100 value
1993	\$4.652	\$4280	\$0.23	\$0.11
1994	4.652	4701	0.23	0.10
1995	4.974	5174	0.23	0.10

evaluates the cost of fire protection as a ratio to the value of property protected. Table 7 summarizes the cost of emergency response over the past three years.

#### **Self-Contained Breathing Apparatus (SCBA) Serviced**

Over 100 SCBA units were checked, serviced, and rebuilt by EMD. This division maintains all SCBA and supplied air-line apparatus used for various specialized operations at LLNL.

#### **Classes Given by Hazards Control**

A total of 1398 H&S classes were given and 10,376 individual course completions were entered into the Laboratory Repository of Completed Courses, the LLNL employee education tracking system. The number of courses will rise compared to the number of completions as more CBT/WBT training is provided because these are counted as one class per student. RCT training will also move the statistics in this direction since much of the practical training is one-on-one. The "academic" RCT training was provided to 40 H&S Technicians in batches this year. In future years, it will be nearly one-on-one because only a few new H&S Technicians will be hired.

#### **PHAs and SARs Performed During 1995**

The ET&SAG was very active working with program customers in 1995 to prepare safety analysis documentation for LLNL facilities. The six FTEs assigned to this work were responsible not only for coordinating the numerous PHAs and SARs, but also performed the detailed technical analyses that were incorporated into these documents. Each of these extensive and lengthy documents typically required hundreds of hours for HCD to prepare and run through the internal LLNL customer approval cycle. The PHAs and SARs are very important in establishing the hazard classification or safety envelope for a building that makes it possible to use a graded approach to implement ES&H controls within the building.

A PHA for determining facility classification was completed for each of the following buildings: 132S, 222, 231, 241, 321A/C, 334, 341, 344, 345, B381 Lab Wing, 391, 394, 518/518A, 406, 520, and 840.

A SAR was completed for each of the following buildings: 231V/232FA/233V, 322, 816, and the Explosive Waste Treatment Facility at Site 300.

In addition, a Justification for Continued Operation was completed for Building 829.

## V. Support to Significant LLNL Incidents

### Centrifuge Failure

On April 26, 1995, the rotor of a small bench-top centrifuge in Building 281, Room 1311, disintegrated and injured a Seaborg Institute Student. The Division Leader, a Health Physicist, Industrial Hygienist, Industrial Safety Engineer, and H&S Technicians from Team 3 and the Health Physics Technical Leader from TSPD responded to the incident. The student received cuts on the right index finger, neck, and chin that were contaminated with high specific activity radioactive materials. EMD paramedics transported the student to the Health Services Decontamination Facility. The decontamination of Room 1311 was completed in June, thanks to Building 332 personnel and Team 3 H&S Technologists. An Incident Analysis was completed and a "Lessons Learned" article published regarding the incident, along with articles in the *LLNL Newslines*, the *DOE Operating Weekly Summary*, and the local newspaper.

The SLD also supported the response to this incident. The Bioassay Lab Team prepared samples to be counted on the gamma counter; processed medical waste, urine, and fecal samples; and analyzed samples for uranium on the Kinetic Phosphorescence Analyzer.

The Whole Body Counter Team completed many wound and whole body counts to assist in determining the total dose. The Analytical Laboratory and Radiological Measurements Teams responded to rush sample counts, and the Industrial Hygiene Instrument Lab and Respirator Lab Teams responded with equipment. The dose received from the incident is in the process of evaluation by the Internal Dosimetry Coordinator. Many of the early wound counts were performed at the Health Services Facility using a portable system brought on line earlier in the year.

### Employee Fall

The Team 3 Industrial Safety Engineer responded to a call involving an Engineering Technical Associate who slipped and fell backwards while climbing stairs in Building 321A, R-1037. The employee unknowingly stepped backwards into a pool of vacuum pump oil that had leaked out of a stored pump just before

he started climbing the metal stairs. When he slipped, he was carrying items in his hands that apparently prevented him from holding onto the handrail. The fall resulted in momentary unconsciousness and trauma to his head, neck, and spinal cord that required hospitalization. This injury was recordable as a lost workday injury. It was also reported to the DOE as an Off-Normal Occurrence. Due to the severity of the incident, DOE convened a Type B accident investigation to which Team 3 provided support.

### Power Outage

ES&H Team 1 staff provided emergency and investigative support to the following incident, which was reported to DOE as an Unusual Occurrence. A maintenance mechanic on a weekend tour of the Plutonium Facility noted an abnormal accumulation of rainwater in a conduit run. When he attempted to remove a sealing compound from the conduit using a large, long-bladed screwdriver, the screwdriver contacted the high-voltage conductors (480 V). The screwdriver was also in contact with the conduit that supplied the ground path. The maintenance mechanic was not injured in the incident. Power to the facility was interrupted for approximately 9 hours while electricians replaced the damaged conductor.

### Finger-Ring Dosimeter Contamination

A glove failed during use for personnel protection during P-32 work, contaminating the skin of a researcher. ES&H Team 2 staff investigated the incident. They consulted with the manufacturer of the glove, who indicated that this particular type was only intended for clean room operations (i.e., protection of products, circuit boards, etc.) and not for personnel protection. Supplies of the glove type in question were removed from stock, replaced by a more durable glove, and a "Lesson Learned" was issued.

### Beamlet Spatial Filter Implosion

During evening operations in early April 1995, a Beamlet laser spatial filter fractured and imploded under vacuum, causing an estimated \$128,000 damage and temporarily halting the project. The area in

Building 381 where this occurred was unmanned during a system shot, and therefore no one was endangered by the incident. The DOE/Oakland Operations Office reviewed the situation and formed a Type B Accident Investigation Board to determine root causes of the incident and fix judgments of need for corrective actions. An Industrial Safety Engineer from ES&H Team 2 served on the Board and also on the three-member interview team that developed a

case history and sequence of events for the incident. The safety engineer assisted with calculations for establishing a “keep out” exclusion zone around the Beamlet spatial filters when they are under vacuum. The exclusion zone provides a safeguard against ear drum rupture in the event of another spatial filter implosion. Additional inspection methods to assess optics damage were developed and will be incorporated into the operation of the NIF.

## VI. Professional Publications and Presentations

As always, many important health and safety related papers, articles, and other professional documents were published by HCD staffers in 1995. A partial list of some of the significant works and presentations is given here.

Beason, Donald G., James S. Johnson, Kenneth L. Foote, and William Weaver, *Summary Report California Department of Forestry and Fire Protection Evaluation of Full-Face Respirators for Wildland Fire Fighting Use*, Lawrence Livermore National Laboratory, Livermore, CA (UCRL-CR-122559) 1995.

Borzileri, Chuck, "High Pressure Facility at LLNL," *NASA/DOD Pressure Systems Seminar*, Orlando, Florida, 1995.

Borzileri, Chuck, "LLNL/DOE Pressure Safety Program," *NASA/DOD Pressure Systems Seminar*, Orlando, Florida, 1995.

Brereton, S. J., T. Altenbach, W. Banks, G. Brumburgh, S. Cantlin, J. Halstead, D. Heinrichs, T. Ladran, J. Mason, D. Pomplun, D. Serpa, and H. Woo, "Inadvertent Criticality Accident Analysis for LLNL's Plutonium Facility," *5th Annual DOE Energy Facilities Contractor Group Meeting, Safety Analysis Workshop*, June 19-23, 1995.

Campbell, George, and Joel Wong, "Environmental Safety and Health Requirements at a Federal Facility," *Proceedings of the 12th Annual HAZMA-CON*, April 1995.

Counts, David, and Joel Wong, "Repetitive Stress Injury Reduction at LLNL through Employee Involvement," *DOE Quality Summit*, May 1995.

Homann, Steve, *Hotspot Health Physics Codes for the PC* (Russian version), Lawrence Livermore National Laboratory, Livermore, CA (UCRL-MA118617) 1995.

Johnson, James S., and S. Z. Mansdorf, Eds., *Performance of Protective Clothing, 5th ASTM Symposium*, 1995. This publication improved standards for the performance of protective clothing for all personnel at LLNL.

Lipska-Quinn, Anne E., Ronald Lopez, Conrad Woods, Ray Mazuch, and Kenneth Lee, *Pantex Materials Database for W-56 Dismantlement and Disposition of Parts*, Lawrence Livermore National Laboratory, Livermore, CA (UCRL-ID-121390) 1995.

Lipska-Quinn, Anne E., Ronald Lopez, Debra Mason, and Kenneth Lee, *Pantex Materials Database for W-70 Dismantlement and Disposition of Parts*, Lawrence Livermore National Laboratory, Livermore, CA (UCRL-ID-121386) 1995.

Lipska-Quinn, Anne E., Ronald Lopez, Robert Schuldheiz, Elvis Spencer, and Kenneth Lee, *Pantex Materials Database for W-71 Dismantlement and Disposition of Parts*, Lawrence Livermore National Laboratory, Livermore, CA (UCRL-ID-121391) 1995.

Lipska-Quinn, Anne E., Ronald Lopez, Robert Schuldheiz, Elvis Spencer, and Kenneth Lee, *Pantex Materials Database for W-79 Dismantlement and Disposition of Parts*, Lawrence Livermore National Laboratory, Livermore, CA (UCRL-ID-121392) 1995.

Lipska-Quinn, Anne E., Ronald Lopez, Robert Schuldheiz, Elvis Spencer, and Kenneth Lee, *Pantex Materials Database for W-84 Dismantlement and Disposition of Parts*, Lawrence Livermore National Laboratory, Livermore, CA (UCRL-ID-121394) 1995.

Mallett, M. W., D. P. Hickman, D. A. Kruchten, and J. W. Poston, Sr., *Development of a Method for Calibrating In Vivo Measurement Systems Using Magnetic Resonance Imaging and Monte Carlo Computations*, Lawrence Livermore National Laboratory, Livermore, CA (UCRL-JC-106915) 1991.

Prokosch, D. W., R. L. Simpson, and R. W. Swansiger, *Explosives Handling and Stability Review Interval Program at LLNL*, Lawrence Livermore National Laboratory, Livermore, CA (UCRL-ID-120263) 1995.

Singh, Mike S., G. W. Campbell, and H. N. Kornblum, *Radiation dose levels generated by the interactions of intense short laser pulses with substances*, Lawrence Livermore National Laboratory, Livermore, CA (UCRL-JC-119765ABS) 1995.

Sutcliffe, W. G., R. H. Condit, W. G. Mansfield, D. S. Myers, D.W. Layton, and P.W. Murphy, *A Perspective on the Dangers of Plutonium*, Lawrence Livermore National Laboratory, Livermore, CA (UCRL-JC-118825) 1995.

## VII. Areas of Concern

Effects due to changes in resources (e.g., funding, staff) or requirements that may impact operations at Lawrence Livermore or are of concern to the HCD Leadership are discussed in this section.

### Off-Shift H&S Technician Program

During off-shift hours, weekends, and holidays, HCD keeps a single H&S technician on duty at LLNL to provide ES&H support for on-site emergencies. The technician is also available to perform special ES&H-related activities (e.g., conduct building tours, issue roof access permits, monitor areas) at the request of various programs. Currently, no institutional (overhead) dollars are used to fund this program. All the cost (4.5 FTEs) is borne by the organizations requesting special activities. Recently, some organizations have been reluctant to pay for a program that also directly benefits areas outside their organization. If one or two organizations that fund the lion's share of the off-shift program withdraw their funding allocations, the overall program will be insufficiently funded and will have to end. This could seriously impact the time it takes for specially qualified personnel (e.g., all off-shift H&S technicians are certified as Radiation Control Technicians) to respond to emergencies. It will also impact HCD's ability to provide appropriate health and safety guidance to others (e.g., fire fighters, maintenance personnel, security personnel) responding to emergencies at LLNL. While HCD has explored other ways of meeting the needs for off-hours ES&H support (e.g., call-out list, on-call emergency duty officers, additional training in ES&H for EMD fire fighters), the current off-shift technician program has consistently been shown to be the most cost-effective option.

### DOE Order Reduction Effort

The DOE Order reduction effort has led to less prescriptive DOE requirements. This has been welcomed by DOE contractors. HCD not only supports this but was also very involved in the effort to convince DOE to allow greater flexibility in meeting requirements. However, in some areas, the new orders have added more items for LLNL to do, which could increase the cost of Laboratory operations. For

example, the new transportation safety order, if accepted by UC for use at LLNL, would require LLNL to package and handle the internal (i.e., within the boundaries of LLNL-Livermore or LLNL-Site 300) movement of hazardous/radioactive materials between buildings just as if the materials were being shipped outside LLNL on public roadways. Meeting the Department of Transportation regulations on training, shipping containers, certification of drivers, and vehicle specification would add several hundred thousands of dollars annually to the cost of moving items around LLNL.

In addition to the direct reduction and consolidation of DOE orders, some orders are being converted into federal regulations (e.g., 10 CFR 835). Noncompliance would no longer be just a contractual issue between UC and the DOE, but a potential violation of federal law that could subject UC/LLNL as an institution, or even individual UC/LLNL managers, to civil or criminal prosecution. As such, more attention is given to strict compliance to the requirements of these laws with less allowance for interpretation based upon LLNL operations. In the past, the concern that LLNL might unknowingly fail to comply with a portion of a new regulation mandated that HCD develop detailed implementation plans and timelines for LLNL compliance with the development cost absorbed by the institution.

Lastly, less prescriptive mandates, reduced funding, and a general move toward industry standards, coupled with hazards that are unique to an R&D environment, will require LLNL line managers to remain on guard against inadvertently increasing risk in their operations. More than ever, HCD will continue to work with LLNL programs to help them achieve and maintain the level of safety that is both cost effective and appropriate for the work they are pursuing.

### Safety Analysis Support

There will be a continuing need for effort in the safety analysis area, directed toward maintenance of existing documentation and support for development of the safety basis for new programs or operations. As part of the maintenance effort, there will be a

need—and in some cases a requirement—for formal annual or triennial reviews of approved safety analysis documents. This will also require a more formal link between the limitations, such as technical safety requirements (TSRs), contained in the safety analysis documentation for a facility and the review of OSPs/FSPs intended to cover operations in the facility.

Present plans call for HCD to significantly reduce its capability to prepare and review safety analysis documentation for program customers.

### **Hazards Control Design Review**

The lack of a formal HCD review requirement for all contractor submittals on major construction projects was identified as a concern in 1995. While design reviews by HCD are required for conceptual design and overall design, there is no signature requirement for subsequent contractor submittals of detail drawing packages and work plans (e.g., fire sprinkler system designs, shop drawings, asbestos abatement plans). Failure to properly identify and resolve issues in all design phases, as well as other pre-construction phases, is of particular concern to the programs because problems noted after construction is completed are frequently corrected at program expense. HCD will be working with PE to resolve this concern and ensure that ES&H-related issues are properly identified and corrected during every stage of design and project planning.

### **Inspection and Recertification of Pressure Vessels and Systems**

Significant downsizing in the High Pressure Laboratory has contributed to the number of pressure vessels and systems that are overdue for triennial reinspection. More than 100 are overdue now, and the risk will increase as more vessels and systems become overdue for either inspection or recertification. HCD will be working with Program Assurance Managers to help them develop efficient approaches (i.e., removing from service, derating, inspecting) and priority-based schedules to resolve the backlog of vessels and systems due for inspection.

### **Available Resources vs. Legacy Facility Issues**

Space and Site Planning, PE Maintenance and Operations, and the ES&H Teams in HCD are working on legacy facility issues in order to return excess

facilities to a caretaker representing LLNL as an institution. There are four paramount areas of concern regarding legacy facilities:

- No designated accounts for routine shutdown, surveillance, and maintenance activities are available to the ES&H teams
- No specific personnel identified as representatives of the institution
- No funding with which to dispose of or demolish facilities in Returned-To-Institution status
- Too many groups working on the issue without communicating with each other sufficiently.

The Facility Assessment Team, led by Space and Site Planning, is actively seeking solutions to these issues, and has established some interim procedures. HCD is represented on this team and is actively pursuing measures to enhance communications between the various groups working the same or similar issues.

### **Attrition in Key Personnel**

HCD is continuing to lose key personnel from its cadre of subject matter experts. As a consequence, certain technical positions within the department are close to being understaffed. Due to the special set of skills, knowledge, and abilities needed for these positions, finding qualified individuals inside Lawrence Livermore is difficult. Given LLNL-wide restrictions on the hiring of external individuals as career-indefinite UC employees, the ability to fill critical positions is a concern. The HCD divisions are making every effort to meet the needs of department clients or cut support, where appropriate. HCD is filling vacated positions with transfers from other divisions or departments inside the Laboratory. Unfortunately, this strategy does not work particularly well because the learning curve for many HCD positions is quite steep, and most customers want support from qualified HCD staff right now.

### **Injury and Illness Statistics**

In the current atmosphere of cost cutting and downsizing at Lawrence Livermore, HCD is concerned about the changes in injury and illness statistics that appear to stem from the “do more with less” approach. For example:

- Individuals unaccustomed to moving furniture and heavy boxes are being asked to do so to conserve declining funds. This, unfortunately, has resulted in back injuries that ultimately cost the programs more money.



- Conscientious employees who continue to work long stretches at their computers to get the job done can very easily experience more repetitive trauma disorders than if they took time for adequate breaks and exercises.

In times like these, it is important for line managers and supervisors to continue to strongly emphasize that it does not pay to shortcut safety to save time, and that the performance of activities in a manner that inappropriately risks the health of employees is not acceptable.

## **Criticality Safety**

Staffing for Criticality Safety is of concern, given the limited number of criticality safety engineers at LLNL and the effect this has on the timelines for reviews of procedures and documents. The difficulty in hiring qualified individuals is exacerbated by the small number of criticality safety experts in the world. Hiring has also been impacted by a general unwillingness of external candidates to take limited-term UC or contract positions at Lawrence Livermore.

## VIII. Plans for 1996

In 1996, HCD will continue to emphasize its commitment to the APP and work with customers and stakeholders to improve the quality of department services. HCD will look for ways to provide services in a cost-wise manner and continue to carry out its mission using technically sound and responsible solutions to ES&H issues.

In the past, the department has proactively met the ES&H needs of LLNL, and is committed to doing so in the future. As Lawrence Livermore continues to move forward in an era distinguished by changes in mission, levels of funding, and external regulations and oversight, HCD must stay dynamic yet maintain core technical competencies in order to support the Laboratory in whatever direction is required.

Some of the department activities planned for the coming year are described below.

### ES&H Teams

#### NIF Design

ES&H Team 2 will continue to support the detailed design efforts for the NIF, including site selection and the design of ancillary buildings needed for it.

#### Radioactivity Allowance Tracking System

H&S Technicians from ES&H Team 3 will be implementing a new Radioactivity Allowance Tracking System within C&MS facilities. This new system will allow C&MS to keep track of the types and quantities of radioactive materials as they are moved into and out of C&MS facilities. H&S Technicians will be responsible for entering all transactions into the new system.

#### Partnership Program Pilot

ES&H Team 4 is exploring a Partnership Program Pilot with ES&H Team 1. Teams 1 and 4 believe that this type of working partnership will enhance the depth of each team's support structure, facilitate an understanding of the partner team's work, and expand networking capabilities with clientele. The pilot program will be designed to retain the individuality of the teams and maintain client-team bound-

aries as appropriate. It is hoped that the pilot can enhance an integrated response to client needs and invigorate innovation at the grass-roots level. Some experimental objectives could focus on the advantages of load sharing, cross-training, and administrative cooperation. The primary aims are to facilitate inter-team transfers, furnish deeper ES&H insight into generic problems, and field an expanded issue resolution capability.

#### Construction Subcontractor Safety Plan

ES&H Team 4 is upgrading Supplement 1.11, "Construction Subcontractor Safety Plan," in the *H&S Manual* to enhance the LLNL approach to construction safety. The "Safety, Accident Prevention, and Fire Protection Plan" in this Supplement is intended to make all personnel working on a construction subcontract thoroughly aware of the need to eliminate all possible causes of accidents. This revision will better enable subcontractors to understand just how important ES&H issues are to the Laboratory. ES&H Team 4 is promoting the concept that a good safety plan is only useful when a subcontractor has a good safety attitude.

#### Donation, Utilization, and Sales

ES&H Team 4 is supporting DUS by determining the safety requirements for a generic pilot subcontract for demolition services. This pilot subcontract differs from the usual contract for services let by Lawrence Livermore in that the subcontractors pay the Laboratory for the right to come on site and remove specified program-owned equipment. The subcontractors then realize financial consideration for their efforts via the salvage value of the equipment removed.

#### Accident Prevention Program and Strategic Plan

All four ES&H Teams will continue to work with the programs in support of the department's APP and Strategic Plan. This support includes the following:

1. Focusing team resources to reduce risk and promote workplace safety while providing the

proper balance between institutional and regulatory requirements.

2. Continuing to work with the programs to provide and maintain sufficient levels of high-quality ES&H support while making appropriate adjustments to meet programmatic needs.
3. Maintaining good communications with program management.
4. Reviewing discipline safety programs to improve efficiency and effectiveness and further reduce workplace hazards.
5. Providing cooperative support within HCD to meet budget reductions.

### **Administrative Services Division**

Most ASD customers are internal to HCD.

The division is continuing to look for ways to improve efficiency and effectiveness. For example, ASD is currently transferring human resource and payroll data into a new relational database so that future reports can be generated more efficiently.

### **Technical Support and Policy Development Division**

#### **Direct Access to Material Safety Data Sheets**

TSPD will implement a new computer-based material safety data sheet (MSDS) management system. This will allow employees to view and print data sheets from their work areas. Data for all products on the ChemTrack inventory are being requested and entered into the database.

#### **Electrical Safety Advisory Board**

Hazards Control has established a new Electrical Safety Advisory Board. The primary purpose of the Board is to provide LLNL with a competent technical resource for identification, recommendations, communications, and guidance regarding electrical safety issues.

### **Education, Training, and Safety Analysis Group**

#### **More CBT and WBT H&S Training**

The primary area of effort in H&S Training is to make more courses available in the CBT or WBT format. HCD trainers are upgrading their authoring skills to understand the capabilities and limitations of the present authoring software so that they can generate or modify courses. Some commercial software is available and is being reviewed for possible purchase and use. ET&SAG experience to this point is that such software is usually of low quality; perhaps only one program in 30 seems appropriate for LLNL training.

#### **Multimedia Hardware Evaluation**

ET&SAG is also continually reviewing the state-of-the-art in multimedia hardware. This is changing very rapidly and will affect the balance struck at any one time between classroom presentation, CBT, and WBT. Technical limitations (bandwidth and compatibility) and equipment limitations (recabling LLNL and upgrading desktop computers) must be considered at the present time because improvements in these areas lie outside the control of HCD. Trainers are keeping current on hardware development to ensure the appropriate mix of high-quality (high-bandwidth) CBT and WBT, which has lower visual quality but is more readily accessible. A particular concern is to avoid spending time on cutting-edge technologies that will be unavailable to the general LLNL population unless ET&SAG can provide access through workstations at the CBT center.

In the 10 months since ET&SAG started to provide CBT, the student load has increased from one or two students a week to the point where all eight workstations are full. Continued growth at this rate may require the purchase of more workstations, although coordination of HCD's efforts with those of EPD and Safeguards and Security may reduce or delay the need for further purchases.

## IX. References

1. *Health & Safety Manual*, Lawrence Livermore National Laboratory, Livermore, CA (Hazards Control Department, M-010) latest edition.
2. *Exposure Assessment and Monitoring Plan*, Lawrence Livermore National Laboratory, Livermore, CA, April 1995.
3. Goodwin, S., *Environmental Compliance Manual*, Lawrence Livermore National Laboratory, Livermore, CA (UCRL-MA-118090-REV-1) August 1995.
4. Leeds, S. G., *Fire Protection Program Manual*, Lawrence Livermore National Laboratory, Livermore, CA (UCRL-MA 116646) June 1994.
5. *LLNL Radiation Protection Plan*, Lawrence Livermore National Laboratory, Livermore, CA, December 1995.